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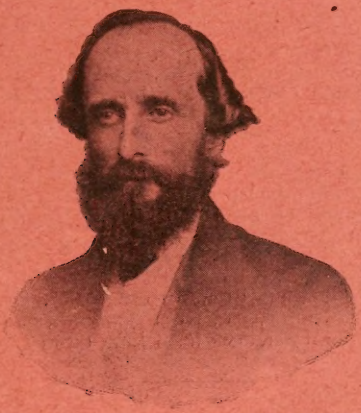

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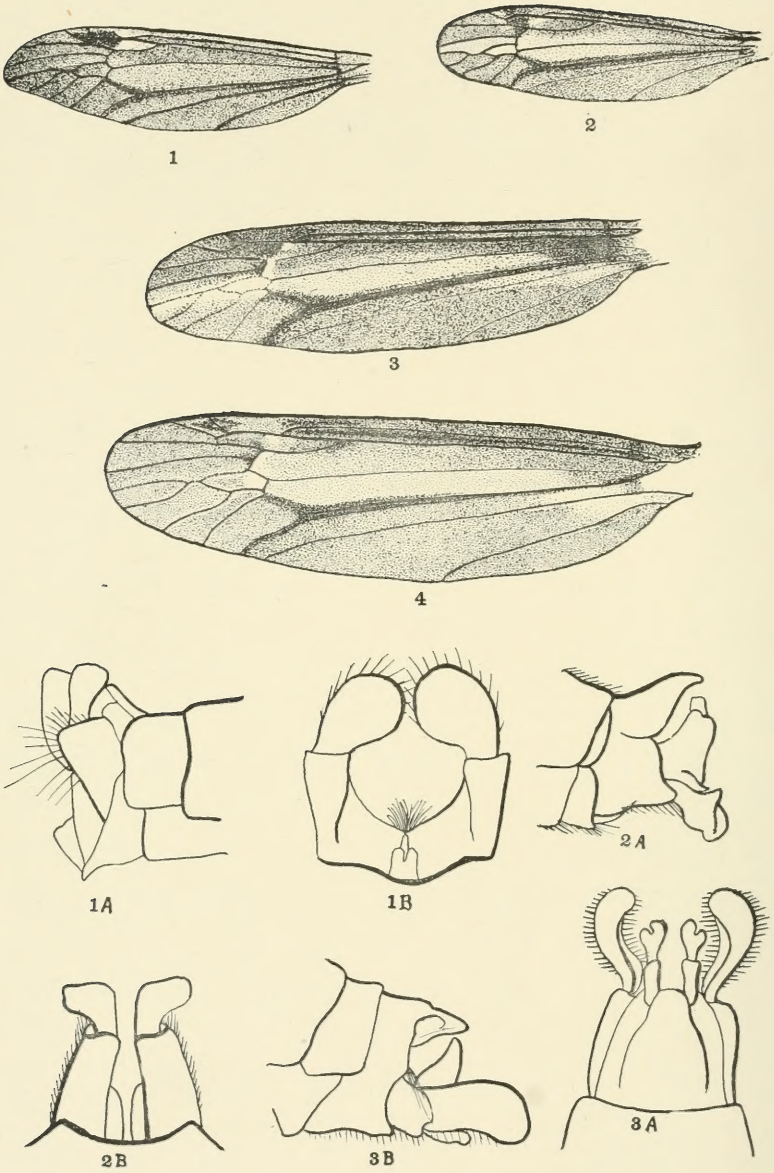

1-1B, TIPULA ALEXANDRIANA; 2-2B, T. VICINA; 3-3B, T. CONSPICUA; 4, T. XANTHOSTIGMA.—DIETZ.

ENTOMOLOGICAL NEWS

AND

PROCEEDINGS OF THE ENTOMOLOGICAL SECTION

THE ACADEMY OF NATURAL SCIENCES, PHILADELPHIA.

VOL. XXVIII. APRIL, 1917. No. 4.

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Key to the North American Species of the Tricolor Group of the Dipterous Genus Tipula Linnaeus,

With Descriptions of Four New Species.

By W. G. DIETZ, M.D., Hazleton, Pennsylvania.

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[1]Can. Ent. Vol. XLVIII, p. 49.
[2]Ibid. p. 50, placed here tentatively.

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Tipula alexandriana spec. n. (Pl. XI, fig. 1, 1A and 1B).

Joints of antennal flagellum with the exception of the first, unicolorous, dark brown. Median vitta of praescutal mesonotum, divided by a pale stripe. Wings without fuscous costal stripe. The hyaline vitta does not extend beyond the extreme base of cell $1M^2$.

♂.—Length 13-14 mm.; wing 16 mm.

Head grayish-white, middle of front fuscous, occiput suffused with fuscous. Joints 1-3 of palpi yellowish-fuscous, 4 dark fuscous. Frontal prolongation rather short, yellow, with a whitish bloom, and, like the nasus, beset with short blackish hairs. Antennae robust; extended backward they reach to the base of the abdomen; scapal joints and basal half of first flagellar joint, yellowish, the rest of the flagellum black, segments with well-marked basal and sub-apical enlargement, basal setae of moderate length.

Thorax. Pronotal scutum yellowish-fuscous. Mesonotal praescutum a sordid, pale yellow, stripes black, conspicuous, the median stripe narrowed posteriorly and divided by a moderately wide stripe of the ground color; lateral stripes abbreviated, parasutural foveae and antero-lateral margin of mesonotum black. Pronotal scutellum and pleuro-dorsal membrane yellowish. Pleura black, overlaid with a heavy whitish bloom, which almost completely conceals the ground color.

Scutum grayish-fuscous, darker in middle portion. Scutellum yellowish-fuscous. Postnotum grayish-fuscous, lateral margins pale. Halteres pale, knob fuscous.

Legs slender, coxae gray and beset with soft pale hairs; trochanters and basal part of femur yellow, remainder of femur yellowish-fuscous, dark fuscous at tip, tibiae and tarsi dark fuscous.

Wings grayish-fuscous, darker apically, yellowish at the base and along cell C and cell Sc, no fuscous costal stripe; stigma dark brown, preceded by a conspicuous hyaline spot; the vitta occupying cell M is but a shade paler than the ground color, not conspicuous, and does not extend beyond the extreme base of cell 1st M^2; vein Cu and its basal deflection conspicuously margined with fuscous.

Abdomen deep yellow, paler beneath with a conspicuous black stripe each side, the latter does not extend beyond the sixth segment; the seventh segment entirely yellow, the extreme posterior margin of segments 1-6 a trifle paler; 8 and hypopygium brown, appendages yellowish; eighth sternite simple, not emarginate; ninth tergite short, posterior margin feebly emarginate each side; ninth sternite with rounded emargination, from the lateral margin of which arises a pencil of bristle-like, yellowish hair, and a carina-like process at the base of the median suture; upper appendages broad, leaflike, inflexed, the lower appendages form an ascending irregular lobe.

♀.—Length 12 mm.; wing 19 mm. Aside from its larger size the female differs from the male by the much shorter antennae, which scarcely reach the middle of the mesonotum, first flagellar joint yellowish-red, flagellar joints cylindrical with slight basal enlargement. Ovipositor brown at base, blades yellow, upper valves very long, almost linear, the lower valves more than one-half the length of the upper valves.

Holotype, ♂. Foothills of Mt. Shasta, California, May 20th, 1914 (A. Kusche).

Allotype, ♀, May 26th, 1914, topotypic.

Paratype, ♂, Sonoma County, California, April 18th, 1914 (A. Kusche). All in the author's collection.

Readily distinguished from the other members of this group with unicolorous antennal flagellum; from *fulvolineata* Doane by only the three basal joints of the antennae yellow[1] and the veins in apical part of wing not margined with fuscous.

[1] A male specimen in my collection from Los Cerritos, California, and received from Mr. M. C. Van Duzee, I unhesitatingly refer to this species, although only three basal joints of the antennae are yellow. The type of the species is a female.

From *aspidoptera* Alexander and *vicina* sp. n., by the pale median mesonotal line.

Two specimens, males, in my collection from La Junta, Colorado (E. J. Oslar), I refer to this species, though apparently differing. The head and thorax are dark brown, the mesonotal stripes black. This difference in color is due to the process of preservation. The abdominal stripes extend upon the seventh tergite.

Respectfully dedicated to Mr. Charles P. Alexander.

Tipula vicina spec. n. (Pl. XI, figs. 2, 2A, 2B.)

Grayish-brown. Antennal flagellum brown. Mesonotal stripes margined with fuscous, the median stripe divided by a blackish line. The hyaline vitta of the wing extends through cell 1st M^2 and cell R^5 to the apex.

♂.—Length 11.5 mm., wing 13 mm. *Head*—Grayish-brown, paler along the upper orbital margin, with dark median occipital line. Rostrum sordid yellow, nasus beset with whitish hairs. Palpi fuscous, the last joint shorter than the preceding joints together. Antennae slender; bent back, they reach to base of halteres; scapal and first flagellar joints yellowish-brown, the following joints fuscous, basal enlargement feeble, black, the setae shorter than the segments.

Thorax—Mesonotum grayish-fuscous with a yellowish sheen, the praescutal stripes scarcely darker than the ground color and margined with fuscous, the median stripe divided by a black median line; pronotal scutum brownish; scutellum and postnotum yellowish-brown. Pleurodorsal membrane sordid yellowish. Pleura gray with a whitish bloom. Halteres yellow at base, darker towards the club, the latter fuscous.

Legs yellow with whitish bloom; femora darker towards and infuscate at the apex; tibiae yellowish-fuscous, their apices and the tarsi fuscous.

Wings grayish-fuscous; the fuscous costal border includes the basal portion of cell R and all the radial cells except R^5; a small hyaline spot before the stigma, the latter dark brown; the hyaline vitta of cell M and outer part of cell R extends through cell 1st M^2 and cell R^5 to the apex; a conspicuous hyaline spot at apex of cell R and base of cell 1st M^2; vein Cu and its basal deflection margined with fuscous.

Abdomen above pale yellowish-gray, a broad, pale fuscous stripe each side, a black transverse line each side, behind the anterior margin of segments 2-5, lateral margins of segments broadly, the posterior margin very narrowly, paler, the former with a small brown dot on tergites 2-7; venter gray, yellowish towards the base. Eighth sternite

simple. Hypopygium yellowish-brown; the ninth tergite a little longer than wide and produced mesially into a short, obtuse lobe, the ninth sternite deeply divided, the postero-inferior angle produced; appendages yellowish-brown, the upper broad, irregular, the lower presents an oval, outward bent lobe.

♀.—Length 15.5 mm.; wing 14.5 mm. Antennae short, first joint grayish-brown, joints 2-4 reddish-brown, the remaining segments dark brown, scarcely darker at base. The dark dots on the pale lateral margins of the abdominal tergites less distinct. Ovipositor yellowish-brown, upper valves long and slender, lower valves about two-thirds the length of the upper, blade-shaped.

Holotype, ♂, Floodwood, Schoolcraft County, Michigan, July, 1915 (J. S. Rodger).

Allotype, ♀, topotypic.

Paratypes, one ♂ topotypic, one ♂ Lancaster, New York, May 31st, 1908 (M. C. Van Duzee). All in the author's collection.

Apparently close to *T. aspidoptera* Alexander, from which it is readily distinguished by the narrow median mesonotal line and all R^5 entirely hyaline.

Tipula conspicua spec. n. (Plate XI, fig. 3, 3A, 3B).

Joints of antennal flagellum distinctly bicolored. Thoracic stripes margined with fuscous, the median stripe divided by a dark mesial line. The hyaline alar vitta reaches to the apex. Abdomen yellow without stripes.

♂.—Length 15.5 mm.; wing 17 mm. *Head* grayish-fuscous, a tuberosity behind the antennal insertion; face and frontal prolongation cream-yellow, nasus beset with short black hairs; sides of rostrum brownish. Palpi yellowish-brown, joints 1-3 pale at tip, the last joint shorter than the preceding joints together. Antennae slender; bent back, they reach to the base of the postnotum; scapal joints brownish with a whitish bloom above; flagellar joints slender, subcylindrical with a whorl of black setae, the latter shorter than the respective segments, yellow and, with the exception of the first joint, black at the base, with a whitish bloom.

Thorax—Pronotal scutum gray with a crescentic, fuscous line. Praescutum grayish-white, stripes light-brown, margined with dark brown, the median stripe of equal width throughout and divided by a dark median line. Scutum brown, central part whitish. Scutellum sordid white, a trifle darker anteriorly. Postnotum sordid white, posterior margin darker, surface transversely rugulose, a brownish spot each side. Halteres yellowish-fuscous, paler towards the base, knob brown. Pleura and pleuro-dorsal membrane grayish-white.

Legs slender, yellowish-fuscous; femora and tibiae infuscate towards the tips; tarsi fuscous.

Wings grayish-fuscous, costal border, including cell R almost entirely and cells R^2 and R^3 dark fuscous, vein Cu narrowly, vein Cu^1 more broadly margined with fuscous; the hyaline vitta begins at the basal third of cell M and extends through cell 1st M^2 and the bases of cells M^2 and M^3, and cell M^1 almost entirely to the apex; the dorsal border of cell R^5 is hyaline in its entire length and forms an integral part of the vitta; a conspicuous hyaline antestigmal spot extends to the apex of cell R; basal third of cell M infuscate, bases of cell Cu and cell 1 A hyaline.

Abdomen ochre-yellow without longitudinal stripes and rather faint, pale fuscous striae each side behind the anterior margin of tergites 2-4; tergites 5-8 somewhat infuscate, the eighth sternite simple. Hypopygium yellowish-brown, ninth tergite longer than wide, posterior margin incised each side, the median part somewhat compressed and produced in the form of a cone; from within the lateral incision arises a small inconspicuous pencil of stiff hairs; ninth sternite long, deeply and narrowly divided; upper appendages large, blade-like, incurved; the middle appendages flattened with an acute lance-shaped process, directed dorsad; the lower appendages irregular, ascending, and each ends in two small lobes.

Holotype, ♂, Black Mountains, North Carolina, September, 1913 (W. Beutenmueller). In the author's collection.

Closely resembles *Tipula cluta* Loew, but differs in cells M^1 and M^2, being partially hyaline and the costal half of cell R^5 fuscous. The hypopygium is different in construction.

Tipula xanthostigma spec. n. (Pl. XI, fig. 4).

Yellowish-brown. Segments of antennal flagellum yellow, black at base. Thoracic stripes margined. The alar vitta extends into cell 1st M^2 but does not reach the apex; stigma yellow.

♀.—Length 19 mm.; wing 17 mm. *Head* grayish-yellow with dark occipital line, face yellowish, frontal prolongation yellow, nasus beset with blackish hairs toward the apex; rostrum light brown on the sides. Palpi light brown, darker towards the apex. Antennae short, scapal joints brownish, joints of flagellum yellow, black at base.

Thorax.—Pronotal scutum pale brown, a fuscous line each side. Praescutum yellowish-gray, stripes broad, light coffee-brown and almost entirely concealing the ground color and very narrowly margined with darker brown; the median stripe narrowed posteriorly and divided by a blackish line. Scutum pale coffee-brown, margins paler. Scutellum and postnotum yellow, posterior margin of the latter brownish. Pleurodorsal membrane grayish-yellow. Pleura and coxae yellowish with a white bloom. Halteres pale, knob fuscous.

Legs—Trochanters and femora yellowish, the latter infuscate towards the apex, tibiae and tarsi yellowish-fuscous, darker towards the apices.

Wings light grayish-fuscous, costal border brown; stigma sordid yellow; basal half of vein Cu narrowly, remainder and the basal deflection more widely, margined with fuscous; a dark-brown spot at the bases of cells R^4 and R^5; the hyaline vitta begins near the base of cell M and extends into the base of cell 1st M^2, the cells bordering the latter, pale, narrowly margined with hyaline; the very conspicuous antestigmal hyaline spot extends into the base of cell 1st M^2.

Abdomen sordid yellow, a broad fuscous stripe each side extends from the base to the eighth tergite, the two stripes leave but a narrow vitta of the ground color between them. Ovipositor ferruginous, upper valves strongly narrowed towards the apex, lower valves a little wider and about three-fifths the length of the upper valves.

Holotype, ♀, Chimney Gulch, Colorado, June 9th, 1914. (E. J. Oslar). In the author's collection.

Readily distinguished from the other species of the group with bicolored, flagellar joints and the alar vitta not attaining the apex, by the yellowish stigma.

EXPLANATION OF PLATE XI.

1.—Wing of *Tip. alexandriana* spec. n.
1 A.—Lateral aspect of hypopygium of same.
1 B.—Ventral aspect of hypopygium of same.
2.—Wing of *Tip. vicina* spec. n.
2 A.—Lateral aspect of hypopygium of same.
2 B.—Ventral aspect of hypopygium of same.
3.—Wing of *Tip. conspicua* spec. n.
3 A.—Dorsal aspect of hypopygium of same.
3 B.—Lateral aspect of hypopygium of same.
4.—Wing of *Tip. xanthostigma* sp. n.

Egg-masses of the Vaporer Moths Wanted (Lep.).

I am venturing to appeal for help in connection with some studies in heredity I am making. I am studying the inheritance of the hair pencils in the larvae of the Vaporer Moths and am very anxious to get egg masses of the Vaporer Moths, *Orgyia* (*Notolophus*) *vetusta* and *O. badia* found on the Pacific coast and also of any other *Orgyia* found in the West. Furthermore, I want to study the gametogenesis, especially the spermatogenesis, of these species and also the behavior of the mitochondria.

In return I shall be pleased to do all I can and I can assist in practically every group of animals or plants.—J. W. H. HARRISON, 181 Abingdon Road, Middlesbro', England.

On Coelophyllum simplex and certain of its Allies (Orthoptera, Tettigoniidae).

By James A. G. Rehn, Academy of Natural Sciences, Philadelphia, Pa.

(Plate XII)

In 1875, Scudder described from the Peruvian Marañon a very peculiar katydid, which he called *Coelophyllum simplex,* new genus and species.[1] These names were not mentioned again until 1896, when Scudder[2] said: "*Coelophyllum* is a genus of Phaneropterinae, not recognized by Brunner in his monograph or in the supplement to it, and which seems to be most nearly allied to the Old World genera forming his group Holochlorae, though very different from either of the three genera recognized by him." Kirby, in 1906, placed[3] the genus in the vicinity of *Phaneroptera,* while Bruner, in 1915, in a key to the American genera of the Phaneropterinae,[4] apparently follows Scudder's suggestion as to its position, as he gives as its diagnostic feature a character which differentiates the Holochlorae and certain other Old World genera groups. This feature is: "Anterior tibiae on their inner margin with the auditory foramina shell-like or sublinear, externally typically wide open."

We now have before us the unique female type of Scudder's genus and species, which we find to be generically inseparable from Brunner's *Prosagoga,* erected, three years later than Scudder's genus, on a species from Surinam.[5] The insect is a most peculiar one, with the tegminal shape and structure, form of the head and pronotum, folding of the wings and structure of the ovipositor quite distinctive. The foramina of the cephalic tibiae are open normal width caudad, while cephalad they are narrowly open, with a trace of a conchate development ventrad, but this is weakly indicated and the surface of the membrane is plainly visible, not fully covered over by the bulla as in forms typically conchate ("shell-like") or linear.

[1] Proc. Boston Soc. Nat. Hist., XVII, p. 263.
[2] Ibid, XXVII, p. 210.
[3] Synon. Catal. Orth., II, p. 437.
[4] Ann. Carneg. Mus., IX, p. 289.
[5] Monogr. der Phaneropt., pp. 29, 320, (1878).

It is quite evident the genus is a modified member of the American group Phyllopterae, and not an isolated American representative of the Old World Holochlorae assemblage. In addition the exact form of the cephalic face of the tympanum of the cephalic tibiae is not a generic feature, as it varies in form within the genus, of which eight species are before us.

We are elsewhere recording or describing, in studies of Brazilian Orthoptera, material of three of the species of the genus. Of the section of the genus represented by *crenulatum* alone in Brunner's last key to the species of the genus,[6] we now have before us five species: *crenulatum* (Brunner), *simplex* Scudder and three other new species. These forms all agree in the important features given in the key for *crenulatum*, i. e. the ramus of the median vein of the tegmina diverging before the middle; in the anal vein (posterior ulnar of Brunner). being acute and crenulate in the male and obtuse in the female, there crenulate only at the base; in the caudal femora being unarmed on the ventro-internal margin.

The five forms may be differentiated from one another by the following features:

A. Marginal field of the tegmina regularly narrowing in width distad, at distal fifth equal to decidedly less than one-half the greatest tegminal width; apex of tegmina rounded or subrectangulate.

B. Pronotum more robust, less compressed, the greatest caudal width of the disk contained one and one-third times in the greatest length of the same. Tegmina with the ramus of the median vein furcate at its middle; free margin of the stridulating field of the male tegmina rectangulate produced at the apex of the stridulating vein; base of the ulnar vein of the tegmina strikingly marked with black.

amazonicum new species.

BB. Pronotum less robust, more compressed, the greatest caudal width of the disk contained one and one-half times in the greatest length of the same. Tegmina with the ramus of the median vein furcate proximad of its middle; free margin of the stridulating field of the male tegmina obtuse-angulate produced at the apex of the stridulating vein; base of the ulnar vein of the tegmina not strongly marked with black.

[6] Verhandl. K.-K. Zool.-bot. Gesell. Wien, XLI, pp. 169-170, (1891).

C. Costal margin of the tegmina arcuate distad; general form of the tegmina elongate elliptical. Eyes proportionately larger; face more compresso-bullate. Limbs relatively longer.

D. Size smaller (♂ tegminal length 32-33 mm.). Tegmina proportionately narrower, the greatest width contained more than two and one-half times in the greatest length of the same. Head proportionately narrower, fastigium of vertex more acute.

crenulatum (Brunner).

DD. Size larger (♂ tegminal length 39-40.5 mm.). Tegmina proportionately broader, the greatest width contained not more than two and one-half times in the greatest length of the same. Head proportionately broad, fastigium of vertex less acute.

costaricense new species.

CC. Costal margin of the tegmina obtusely rounded at distal third; general form of the tegmina having the costal and sutural margins approximately parallel. Eyes proportionately smaller; face less bullate, hardly compressed. Limbs relatively shorter ..... **peruvianum** new species.

AA. Marginal field of the tegmina very wide, slightly expanding distad, at distal fifth equal to but faintly less than one-half the greatest tegminal width; apex of the tegmina very obtuse-angulate. (Size largest of the species seen. Head strongly compressed; face greatly compresso-bullate.) ..... **simplex** Scudder.

Coelophyllum amazonicum new species. (Pl. XII, fig. 1.)

Of the members of this group of the genus, *amazonicum* is characterized by the combination of a broadly rounded tegminal apex, a distad narrowing marginal field of the tegmina, a median bifurcation of the tegminal ulnar vein, a rectangulate production of the free margin at the apex of the stridulating vein of the male tegmina and the broad, but moderately compressed pronotum. The type has been dried after immersion in a liquid preservative and, in consequence, has lost almost all of its original coloration. The only features of this preserved are small semilunate spots of black situated at the base of the ulnar and anal veins of the tegmina.

Type.— ♂ ; Contamano, Rio Ucayali, Peru. October to December, 1912. [Acad. Nat. Sci. Phila. Type No. 5312.]

Size small (for the genus); form moderately compressed; surface smooth, of tegmina shining, very closely, finely and deeply cribrosopunctulate.

Head with the interocular space slightly less than the greatest width of the eye; fastigium acute, depressed, sulcate, the apex well separated from the fastigium of the face; paired ocelli large; fastigium of the face distinctly acuminate; face considerably bullate, moderately compressed; eyes ovate in basal outline, compressed, distinctly directed cephalad; antennae surpassing the apices of the tegmina.

Pronotum with the greatest caudal width of the disk contained one and one-third times in the greatest length of the disk, the same moderately narrowing cephalad; cephalic margin of the disk very shallowly and broadly obtuse-angulate emarginate, caudal margin of the disk very broadly arcuate, faintly flattened mesad; lateral margins of the disk rather broadly rounding into the lateral lobes: lateral lobes of the pronotum with the greatest depth slightly more than the greatest length; cephalic margin of the lobes moderately arcuato-sinuate caudad of the eyes; caudal margin regularly and considerably arcuate, the humeral sinus deep, rounded acute-angulate; ventral margin of the lobes with the cephalic section oblique truncate; ventro-cephalic angle rounded obtuse-angulate, ventro-caudal angle indistinguishable in the regular curve of the caudal section of the ventral and the caudal margins.

Tegmina surpassing the apices of the caudal femora by considerably more than the length of the pronotal disk; greatest width of the tegmen contained about two and two-thirds times in the greatest length of the same; form of the tegmina elongate elliptical, slightly prolonged proximad, the distal half more regular in form: costal margin briefly oblique sinuato-truncate proximad, thence rounding into the arcuato-truncate costal margin proper, which regularly rounds distad to the broadly rounded apex; sutural margin (aside from stridulating field) moderately arcuate: marginal field broad, narrowing distad, the greatest proximal width but little less than half the greatest width of the tegmen; mediastine vein weak, bifurcate; discoidal vein in general straight, with regular oblique rami diverging toward the costal margin; median vein with the ramus diverging briefly proximad of the middle, this bifurcate mesad; ulnar vein at the closest point separated from the humeral trunk by one-half the distance separating it from the sutural margin at the point of their greatest remoteness; crossveins of the discoidal field regular (see figure): stridulating field relatively short and very broad, the free margin produced into a rectangulate process at the apex of the stridulating vein; distad of this the margin is sinuato-emarginate; stridulating vein straight, quite thick, sulcate; base of ulnar vein very distinctly paucicrenulate, proximad of

the crenulations is a detached rounded area. Wings very faintly surpassing the apices of the tegmina.

Disto-dorsal abdominal segment with its distal margin arcuate, moderately emarginate at the bases of the cerci; supra-anal plate acute-trigonal, faintly sulcate; cerci in their greater portion tapering, gently curving dorsad, the apex rather sharply curved dorso-mesad, briefly mucronate; subgenital plate produced, narrowing, distal margin U-emarginate, styles relatively short, articulate.

Cephalic femora with two to three spines on the ventro-cephalic margin; median femora with three to four spines on the same margin; cephalic tibiae with slender distal portion faintly longer than the inflated proximal section. Caudal femora equal to one-half the tegminal length, moderately tapering; ventro-external margin with fifteen to seventeen spines distributed over its whole length, ventro-internal margin with three to five spines on distal half.

Natural coloration of specimen destroyed by liquid immersion except for the following features. Eyes mars brown. Semilunate spot encircling the detached rounded knob at the base of the ulnar vein of the tegmina, black; stridulating vein prout's brown; distal section of the sutural margin of the tegmina bearing several well separated groups of dark points, such as are found more decided in certain other forms of this species group.

Length of body, 19.5 mm.; length of pronotum, 5.5 mm.; greatest (caudal) width of pronotal disk, 4.3 mm.; length of tegmen, 28.5 mm.; greatest width of tegmen, 11.9 mm.; length of caudal femur, 15 mm.

The type is unique.

Coelophyllum crenulatum (Brunner). (Pl. XII, fig. 2.)

1891. *Prosagoga crenulata* Brunner, Verhandl. K.-K. Zool.-botan. Gesell. Wien, XLI, pp. 170, 171. [Pernambuco and Alto Amazonas, Brazil; Guiana.]

We have before us a single male of this species from Caparo, Trinidad (June, 1913; S. M. Klages), belonging to the collection of the Academy of Natural Sciences of Philadelphia. It can be readily differentiated from *amazonicum* by the characters given in the key, but from *costaricense* the distinctions are not as easy to appreciate. Under *costaricense* we have given the diagnostic features separating the two forms.

Coelophyllum costaricense new species. (Pl. XII, fig. 3.)

This new species is quite close to *C. crenulatum* (Brunner), from which it differs in its larger size, proportionately broader tegmina, somewhat less compressed pronotum and broader

head, with less acute facial fastigium and more robust limbs. The male subgenital plate is also broadly V-emarginate instead of rather deeply emarginate, as in *crenulatum*.

Type.— ♂ ; Cachí, Costa Rica. July 16, 1911. (C. H. Lankester.) [Acad. Nat. Sci., Phila., Type No. 5311.]

Size moderately large; form compressed; surface smooth, of tegmina as in *amazonicum*.

Head with the interspace between the eyes faintly greater than the greatest width of the eye; fastigium acute but immediate apex rounded, undulate depressed, moderately sulcate, apex well separated from the fastigium of the face; paired ocelli large; fastigium of the face relatively acute; face very considerably bullate, rather strongly compressed; eyes ovate in basal outline, moderately compressed, directed cephalad; antennae elongate.

Pronotum moderately compressed (less so than in *C. crenulatum*), the disk narrowing cephalad with its greatest caudal width contained one and two-fifth times in the greatest length of the same; cephalic margin of the disk faintly sinuato-emarginate, caudal margin of the disk strongly arcuate, with a faint median emargination, lateral margins of the disk distinct and continuous, but broadly rounded: lateral lobes of the pronotum with their greatest depth faintly greater than their greatest length; cephalic margin of the lobes sinuate, ventrocephalic angle rounded obtuse-angulate, ventral margin strongly arcuate, faintly flattened cephalad, caudad rounding regularly into the arcuate caudal margin, which is faintly flattened mesad, humeral sinus subacute, deep, with the angle narrowly rounded.

Tegmina surpassing the apices of the caudal femora by twice the length of the pronotal disk; greatest width of the tegmen contained two and one-half times in the greatest length of the same; form of the tegmina elongate-elliptical, slightly prolonged proximad; costal margin as in *amazonicum*, but the distal fourth is oblique arcuato-truncate to the rounded rectangulate apex; sutural margin as in *amazonicum*: marginal field broad, regularly and very considerably narrowing distad, the greatest proximal width but little less than half the greatest width of the tegmen; mediastine vein subobsolete, irregular, bifurcate; discoidal vein faintly flexuous, with rami toward the costal margin somewhat irregular in position, furcation and trend; median vein with the ramus diverging decidedly proximad of the middle, this bifurcate shortly before its middle; ulnar vein at the closest point separated from the humeral trunk by not more than one-third the distance separating it from the sutural margin at the point of greatest remoteness; cross-veins of the discoidal field much suggesting those of *C. amazonicum*, but fewer (see figure): stridulating field relatively narrow, of medium length, the free margin rounded

obtuse-angulate at the apex of the stridulating vein, distad of this the margin is sinuate; stridulating vein much as in *amazonicum;* base of ulnar vein quite weakly but rather closely crenulate, proximal section less decidedly than in *amazonicum.* Wings very faintly surpassing the apices of the tegmina.

Disto-dorsal abdominal segment with free margin much as in *amazonicum,* but median emargination less extensive; supra-anal plate?; cerci of the type found in *amazonicum,* but more incrassate proximad and more slender distad; subgenital plate moderately produced, moderately narrowing, distal margin broadly V-emarginate, styles short, articulate.

Cephalic femora with three spines on the ventro-cephalic margin; median femora with two to three spines on the same margin; cephalic tibiae with slender distal portion slightly longer than the inflated proximal section. Caudal femora less than one-half the tegminal length, moderately robust proximad, considerably tapering distad; ventro-external margin with twelve to thirteen spines distributed over its whole length, ventro-internal margin unarmed.

General coloration of tegmina yellowish oil-green, of the abdomen citron-yellow, of the head and pronotum pale old gold (type) or the tegminal color (paratype). Head with the face whitish, a distinct narrow postocular line bone brown; eyes mottled russet and mummy brown; antennae with the proximal and second joint of the color of the face, remaining joints sudan brown, imperfectly multiannulate with threads of argus brown. Pronotum with the caudal section of the disk and lobes washed with greenish; vicinity of the humeral sinus and the median emargination of the caudal margin touched with mummy brown. Tegmina with (type) or without (paratype) three areas of pseudo-desiccation, of a prout's brown tone, these occasionally outlined in fuscous, and one situated near the base of the ulnar vein, another at the base of the median ramus and divided by the ulnar vein, and the third and largest at the bifurcation of the median ramus; in place of these areas the tegmina (paratype) may have numerous scattered fine points of fuscous; distal section of costal margin, and to a lesser degree of the sutural margin, beaded with mummy brown; bounding section of the stridulating field and stridulating vein marked with mummy brown. Limbs ranging from old gold to dull ochraceous-buff, the tibiae and distal extremity of the femora thickly speckled with fine points of fuscous, which are almost entirely absent from the ventral and lateral faces of the caudal tibiae.

Measurements (in millimeters).

Cachi, Costa Rica	Length of body	Length of pronotum	Greatest (caudal) width of pronotal disk	Length of tegmen	Greatest width of tegmen	Length of caudal femur
Type	26	7.2	5.2	39	15.8	16.5
Paratype	22.2	7.1	5	40.5	15.6	16.1

In addition to the type we have before us, from the Academy collection, a paratypic male from Cachí, Costa Rica, taken by Mr. Lankester in January, 1914. This specimen shows no really noteworthy differences from the type except in color, which is mentioned in the above description.

Coelophyllum peruvianum new species. (Pl. XII, fig. 4.)

Closely allied to *C. crenulatum* and *costaricense,* but more particularly to *costaricense,* from which it differs chiefly in the distinct and relatively abrupt obtuse-angulation at the distal third of the costal margin of the tegmina, in the more subparallel major portions of the costal and sutural margins of the same, in the smaller eye, in the less bullate and more weakly compressed face, and in the shorter limbs. The tegminal form is fully diagnostic of this species.

Type.— ♂ ; Chanchamayo, Peru. [Acad. Nat. Sci., Phila., Type No. 5310.]

Size moderately large; form compressed; surface smooth, of the tegmina as in *amazonicum* and *costaricense.*

Head with the interspace between the eyes subequal to the greatest width of the eye; fastigium acute, immediate apex narrowly rounded, undulate depressed, deeply but narrowly sulcate, apex well separated from the fastigium of the face; paired ocelli large; fastigium of face relatively acute; face moderately bullate, appreciably but not greatly compressed; eyes broad ovate in basal outline, moderately compressed, directed cephalad; antennae elongate.

Pronotum moderately compressed, the disk as in *C. costaricense;* lateral lobes as in *costaricense,* but the humeral sinus is shallower and more rectangulate, with the angle more broadly rounded.

Tegmina as in *costaricense,* except for the following differences: Narrower, the greatest width contained faintly more than two and one-half times in the greatest length of the same; costal and sutural margins in large part subparallel; costal margin with the distal third quite sharply oblique truncate to the apex, which is narrowly rounded rectangulate; sutural margin straighter than in *costaricense*: stridulating field relatively shorter and broader than in *costaricense,* the free margin more arcuate distad of the stridulating vein. Wings very faintly surpassing the apices of the tegmina.

Disto-dorsal abdominal segment as in *costaricense;* cerci of the usual type but more slender than in *costaricense,* less incrassate proximad and tapering more regularly; subgenital plate of the type usual in the genus, the distal margin U-emarginate.

Limbs shorter and faintly more slender than in *C. costaricense.* Cephalic femora spined as in *costaricense;* median femora with three spines on the ventro-cephalic margin; cephalic tibiae much as in *costaricense.* Caudal femora considerably less than one-half as long as the tegmina, slightly less robust than in *costaricense*; ventro-external margin with nine to eleven spines distributed irregularly over their whole length, ventro-internal margin unspined.

General color of tegmina oil green, the body and (occasionally) the proximal portion of the tegmina sulphine yellow (type) to dull light cadmium yellow (paratype). Eyes auburn to chestnut brown; a fine postocular line of bay more (type) or less (paratype) distinctly indicated on the head. Pronotum occasionally (type) washed with greenish caudad. Tegmina with three groups of discoidal maculations; the first, which is at the proximal third, is composed of two mummy-brown points, either or both of which may be ocelliform with a buffy centre, one placed at the sutural side of the principal furcation of the median vein, the other on the same side of the ulnar vein; median group, placed slightly distad of the middle, having a weak buffy base and three closely placed spots (the third—sutural—is occasionally subobsolete), which may be ocelliform; the third group placed along the distal fork of the principal ramus of the median vein, at the distal fourth, consisting of a buff line along the vein and on which may or may not be placed two or three mummy-brown points; distal half of costal margin mummy brown, regularly and sparsely beaded with warm buff, which also occasionally colors the tegminal tips; distal section of the sutural margin weakly marked in similar fashion; sutural field washed along the principal veins with mummy brown, this tone strong near the ulnar base. Limbs of the general body color, the tibiae and femora marked as in *costaricense,* more weakly in the paratype than in the type.

Measurements (in millimeters).

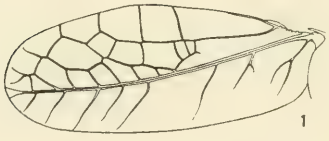
Chanchamayo, Peru	Length of body	Length of pronotum	Greatest (caudal) width of pronotum	Length of tegmen	Greatest width of tegmen	Length of caudal femur
♂ *Type*.....	21.4	6.8	4.8	37.2	14	15.4
♂ *Paratype*.....	20.3	6.6	4.9	37.8	14.3	15.1

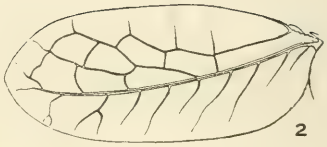
In addition to the type a paratypic male from Chanchamayo, also in the Academy collection, is now before us. This specimen shows no important differences from the type, except for the color features mentioned above.

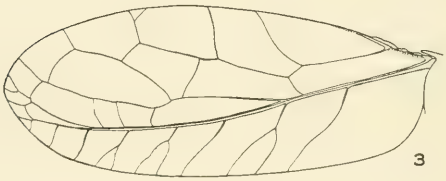
Coelophyllum simplex Scudder. (Pl. XII, figs. 5 and 6.)

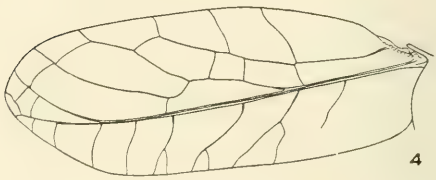
1875. *Coelophyllum simplex* Scudder, Proc. Boston Soc. Nat. Hist., XVII, p. 263. [Peruvian Marañon.]

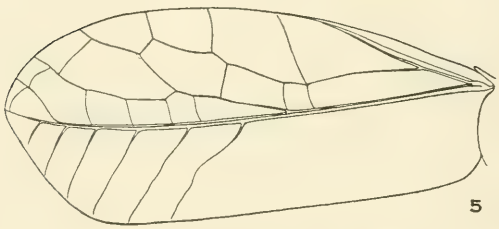
The unique type of this species, as stated by Scudder, has,











COELOPHYLLUM.—REHN.

1.—C. AMAZONICUM.
2.—C. CRENULATUM.
3.—C. COSTARICENSE.
4.—C. PERUVIANUM.
5, 6.—C. SIMPLEX.

by immersion in some liquid preservative, lost all of its original coloration, excepting the dark distal section of the ovipositor. The species is the largest member of this group and probably of the genus. This statement, however, may require modification when both sexes of all the described species are known.

The extensive character of the marginal field of the tegmina and the form of the tegminal apices are quite characteristic of this species, while the compression of the head and the bullation of the face are marked to an exceptional degree.

Type measurements: length of body (exclusive of ovipositor), 25.3 mm.; length of pronotum, 8.2 mm.; greatest (caudal) width of pronotum, 6.4 mm.; length of tegmen, 42.8 mm.; greatest width of tegmen, 19 mm.; length of caudal femur, 18.2 mm.; length of ovipositor, 6.5 mm.

The ovipositor structure of this individual, the only female of this species group known to us, is so striking it seems desirable to figure it. To what degree the other forms of the group exhibit a similar imbricated structure of the ovipositor surface remains to be determined.

EXPLANATION OF PLATE XII.

Outline of tegmen (lateral aspect). (x 1½.)

Fig. 1.—*Coelophyllum amazonicum* new species. ♂ *Type*. Contamano, Peru.

Fig. 2.—*Coelophyllum crenulatum* (Brunner). ♂. Caparo, Trinidad.

Fig. 3.—*Coelophyllum costaricense* new species. ♂ *Type*. Cachí, Costa Rica.

Fig. 4.—*Coelophyllum peruvianum* new species. ♂ *Type*. Chanchamayo, Peru.

Fig. 5.—*Coelophyllum simplex* Scudder. ♀ *Type*. Peruvian Marañon.

Outline of ovipositor (lateral aspect). (x4.)

Fig. 6.—*Coelophyllum simplex* Scudder. ♀ *Type*. Peruvian Marañon.

Influence of Rainfall on Abundance of a Moth (Lep.).

Results of several years' observations in Louisiana, Cuba, Jamaica, Trinidad and Barbados and careful status examination for two years in Porto Rico show that the abundance of the Sugar-Cane Moth Stalk Borer (*Diatraea saccharalis*) varies inversely with the rainfall.—G. N. WOLCOTT, University of Illinois.

Mating Habit of the Cottony Cushion Scale (Hem., Hom.).

By G. O. Shinji, Berkeley, California.

While studying the life history of the cottony cushion scale (*Icerya purchasi*) for a certain experimental purpose, our attention was called to a peculiar process of mating exhibited by this insect. So far as our knowledge goes the mode of mating in the cottony cushion scale has never been described. It is, therefore, thought that the present paper may not be out of place.

The adult male, soon after the last molting, folds his wings flat on his back and remains inactive for a period of about three days. Then, either early in the morning, or, more generally, on a warm, dusky evening, he crawls on a nearby twig to search for his mate. As soon as he finds a mature and yet virgin female, he crawls on her back, pats her abdomen with the tip of his genital prominence two or three times, and then slowly and gently slips alongside of his mate, but never across her head. Then he proceeds directly toward the upper end of the twig or the branch, as the case may be. At the end of the twig he turns around and comes back to the female again. If at this time the bride he engaged signifies her acceptance by elevating her abdomen from the surface of the twig, a copulation takes place; if not, he repeats the same process several times. In three instances we have observed the male, after the second approach to the female, which has not yet responded, try successfully to dislodge her abdomen from the twig by the use of his front pair of legs. However stubborn females seemed to be at first, they yielded to his wishes in the long run, and a copulation resulted.

Altogether, in thirty-two copulations observed so far, the process was practically the same; he curls his abdomen up and around the posterior end of the female until the penis is inserted into the genital aperture of the female. This process is made possible by his holding himself on the fringe of the female by the hind legs, and also by the support of the wings, which are placed firmly against the twig. No movement of

antennae or of the wings was observed. While they are in copula his antennae are dropped freely downward, making a right angle with the long axis of the body. The first two pairs of legs are, on the contrary, stretched upward, making also a right angle with the line of the body. The hind legs, as already mentioned, hold the posterior portion of the female's abdomen, while the wings are held in such a manner as to embrace the twig between their distal ends.

One of the characteristic features observed in the copulation of the cottony cushion scale is, then, the right-angularity presented in the relative position of the male and female, and also of several parts of the male. Both the antenna and the legs of the male are each perpendicular to the body and the body itself (of the male) is, in turn, at a right angle with that of the female. In this respect the manner of copulation in *Icerya purchasi* differs from what has been observed in other animals. Mr. Putnam,[1] who observed the process in the cottony maple scale, *Pulvinaria innumerabilis* Rathv., states: "the male mounts the back of the female with his head in the same direction with the female's and vibrating his antennae rapidly." Mr. Turner[2] observed a similar manner in one of the parasitic bees (Stelidae). Among other animals, Amphibia, for example, agree in the main with the type of copulation mentioned by Turner. My personal observations on *Sinea diadema, Zelus socius,* most of the Aphids, *Murgantia histrionica,* certain Capsids, *Meloe, Hippodamia convergens, Diabrotica soror* and *Musca domestica* among insects, and also on other invertebrate, as well as vertebrate, animals, all agree with the type of copulation exhibited by the cottony maple scale, i. e., the male mounts the back of the female with his head in the direction of the female's. Certain Lepidopterous insects, the silk-worm moth, for example, are often observed in copula with the head of the male turned exactly in the opposite direction from that

[1] Putnam, J. Duncan. Biological and other notes on Coccidae. I. Pulvinaria innumerabilis. Proc. Davenport Acad. of Nat. Sci., vol. II. Dec., 1879.

[2] Turner, C. H. Notes on the behavior of a parasitic bee of the family Stelidae. The Journal of Animal Behavior, vol. I, No. 5. 1911.

of the female. But even in this case the body of the male and that of the female are in the same line. In other words, in the process of mating in all the animals above mentioned, except that which I found so far in a single species of scale insect, the bodies of male and female are arranged either in the same or in opposite directions, with of course, slight modifications, as against the exact perpendicularity observed in the case of the cottony cushion scale.

The relative time spent in the courting, if we may term the behavior of the male visiting the female prior to the mating as such, and the actual time spent in copula are as follows:

Male No. 1 emerged Feb. 3, 10.30 A. M.; died Feb. 10, 10.25 A. M.

Mating I, February 7:

Located female ....3.00 P.M.	In copula 3.06-3.13
Left her 3.04½	Turned body 3.13
Returned 3.06	Left her 3.14

Male No. 2 emerged Feb. 8, 10.00 A. M.; died Feb. 16, 9.10 A. M.

Mating I, February 13:	II, February 13:
Courting .....4.20-4.30 P.M.	Courting .....5.25-5.32 P.M.
In copula 4.32-4.40	In copula 5.32-5.42

Male No. 3 emerged Feb. 8, 9.45 A. M.; died Feb. 16, 9.12 A. M.

Mating I, February 13: In copula.....4.40-4.48 P.M.

Male No. 4 emerged Feb. 12; died Feb. 19.

Mating, February 15: Courting .....4.25-4.36 P.M.
In copula 4.36-4.44

Male No. 5 emerged Feb. 12 (?); died Feb. 19.

Mating I, February 15:	II, February 15.
Courting .....4.40-4.48 P.M.	Courting .....5.30-5.45 P.M.
In copula 4.48-4.57	In copula 5.55-6.07
Struggled to leave, 4.58-5.08	
Left her 5.15	

Male No. 6.

Mating I, March 2: Courting .....4.25-4.43 P.M.
In copula 5.55-6.07

Male No. 7 emerged March 3, 10.00 A. M.; died March 10.

Mating I, March 6:

In copula .3.40-3.48 P.M.	V. Courting .....7.55-8.05 P.M.
II. In copula .4.35-4.48	In copula 8.05-8.13
III. In copula .5.45-5.55	VI, March 7:
IV. Courting ..6.55-7.05	Courting .....7.20-7.36 A.M.
In copula .7.05-7.13	In copula 7.36-7.45

Male No. 8.
Mating I, March 10: Courting .....3.35-3.47 P.M.
In copula 3.47-3.55
Male No. 9.
Mating I, March 10:
In copula ..3.50-3.57 P.M. III. In copula ....5.40-5.50 P.M.
II. Courting ..4.47-5.01
In copula ..5.01-5.10
Male No. 10 emerged March 8.
Mating I, March 11: Courting .....2.33-2.44 P.M.
In copula 2.47-2.54

It is interesting to note from the above figures that there exists a certain periodicity in the process of mating. There occurred in almost all cases one copulation in an hour, no more and no less. This definiteness in time is also observable in the courting and in the copulation, the average time spent being about ten and seven minutes, respectively. The same table also shows the fact that the males do mate with more than one female, to as many as six.

Another very interesting fact observed in this connection is that which pertains to the function of the wings and balancers of the male. Since, as Mr. Gossard[3] stated, the male rarely takes to flight, the wings of this male scale insect are of more use as the support for the body during the process of copulation. In this explanation we see the significance of the presence of a highly modified pair of balancers. The balancers of this insect end each with a hooklet, with which they hold on the wings and strengthen the latter.

If the wings are useful for flight only this elaborate process on the balancers may not be necessary. Dipterous insects possess, as we know, a pair of balancers, but with no hooklet. They nevertheless fly as easily as other insects do. The balancers of the cottony maple scale again are lacking in these hooklets. Reasoning thus, I am inclined to believe that the balancers of the cottony cushion scales, whatever their original function might have been, have been so modified as to strengthen the wings during the process of copulation.

[3]Gossard, H. A. The Cottony Cushion Scale. Florida Agri. Exp. St. Bull. No. 56, May, 1901.

Notes on some Buprestidae of Northern California (Col.).

By W. J. Chamberlin, Forest Entomologist, Oregon State College, Corvallis, Oregon.

(Continued from page 139)

44. **Polycesta californica** Lec.

Found throughout the oak region of California, though never common. It has been taken from dead black oak (*Quercus kelloggii*) in Trinity County, Yosemite Valley and Mariposa County; also taken from *Quercus douglasii.*

45. **Chrysophana placida** Lec.

Found throughout the coniferous area of northern California and the Sierras, also well distributed over western Oregon, and no doubt extends into Washington, since the writer has taken it 35 miles south of the Columbia River. Dr. Van Dyke has one specimen bred from the cones of *P. ponderosa.* Mr. Miller, of the Ashland Station, has bred it from the cones of *Pinus attenuata.* Its common host plant is Douglas fir, but it also breeds in the upper part of small lodge pole, yellow and knob-cone pine, and in the edges of fire scars of *Abies concolor* and *A. magnifica.*

There are three phases: a striped phase, which is the more common, and is often taken in open fields on flowers in southern Oregon; an all-green variety, which occurs at higher elevations of the middle and southern Sierras, and which the writer has taken at Corvallis, Oregon; the third variety is unstriped, of a dark bronze or black color, and very scarce.

Dr. E. C. Van Dyke, of the University of California, has very kindly furnished me with his own notes on the hosts, etc., of species he has taken in the northern part of the State. I wish, particularly, to express my indebtedness to Dr. Van Dyke for his notes on the genus *Acmaeodera;* practically all the information on that genus is due to his observations, since I have personally come in contact with but two species, *A. vandykei* and *A. connexa.*

46. **Acmaeodera angelica** Fall.

"Generally to be found flying about brush or in the flowers

of Yerba Santa, *Erydectylon*. Very common in the Sierra Madre range of southern California, but also extends northward. I have specimens from the following more northern localities: Mariposa County, Lake County and Lake Tahoe."

47. **A. hepburnii** Lec.

Very common in most parts of California. Generally to be taken in flowers, such as certain compositae like *Baeria* and in the flowers of the evening primrose.

48. **A. acuta** Lec.

Perhaps even more common than the preceding and found in similar places, also as widely distributed. There are two phases, the common one, where the markings are broken up, and the other, where definite stripes are formed.

49. **A. connexa** Lec.

"Probably the most common species which we have in the State and widely distributed. Usually found in flowers like the two preceding. I have also dug it out of its pupal chambers from the dead branches of oak, *Quercus wislizenii,* in Marin County, California."

50. **A. labyrinthica** Fall.

"This is generally a species of southern California. I, however, have specimens from Castella, July, 1912, and from Tuolumne County."

51. **A. plagiaticauda** Horn.

Found throughout the Sierras, but rare. One specimen has been seen from Siskiyou County, California, and another from Lake Tahoe. Breeds in manzanita.

52. **A. variegata** Lec.

This Rocky Mountain and Great Basin species courses into California through the gaps in the mountains north of Mt. Shasta. "I have beaten specimens from the branches of dead yellow pine at Carrville, Trinity County, California, during June, 1913. I believe that it breeds in yellow pine."

53. **A. vandykei** Fall.

"Found throughout the northern and middle Sierras. It breeds in *Ceanothus*. I have specimens from McCloud, July,

1914; Sissons, July 5, 1900 (type material); Shasta County and Mariposa County." This species occurs in southern Oregon.

54. **A. mariposa** Horn.

"A species of the middle and southern Sierras. I, however, have specimens from Sonoma County and Lake Tahoe and it no doubt extends farther north."

55. **A. dolorosa** Fall.

"A southern species. I have specimens from Lake and Mariposa Counties, and it probably extends much farther north."

56. **A. hornii** Fall.

"Of this Arizona species I have seen what I consider typical specimens from near Placerville, El Dorado County, July, 1906 as well as from Mt. San Jacinto, in southern California. I have also seen a phase in which the marginal patch of yellow is broken up into large blotches (otherwise not different) from near Placerville, Siskiyou County, and from Tuolumne County."

57. **A. gemina** Horn.

"This species is widely distributed in the State, though nowhere common. It is generally to be found resting on twigs or in flowers, such as those of the wild buckwheat, *Eriogonum*. I have specimens from Mariposa and El Dorado Counties, and have seen them from much farther to the north. There are two fairly distinct phases, the var. *nebulosa* Horn, in which the markings are much broken up, and the typical form, in which the markings are of a lineate type. These phases, however, mate indiscriminately and may be found in the same territory."

58. **Agrilus politus** Say.

Abundant throughout the West. Chiefly found on willow in which it breeds, but also on live oak, the fine twigs of which it often prunes, the larvae girdling the twig within the bark. There is a blue phase (perhaps a distinct species), which seems to be confined to the alder.

59. **A. vittaticollis** Rand.

"One specimen taken by F. W. Nunenmacher in Josephine County, Oregon, May 8, 1910, and two by myself at Carrville, Trinity County, California, July 1, 1913, on willow." Dr. Van Dyke.

60. **A. walsinghami** Cr.

Type locality, Yreka, California. Others have been taken in same region; also in Inyo County, California. It breeds in one of the desert shrubs.

61. **A. nevadensis** Horn.

Western Nevada type locality. There are in the Van Dyke collection specimens from the Yosemite Valley taken on poplar. It may possibly extend farther north.

Notes on some recent studies of Dragonfly Wing Tracheation (Odon.).

By J. G. Needham, Cornell University, Ithaca, New York.

It was a fortunate day for the progress of our knowledge of the Odonata when R. J. Tillyard began his observations on the dragonflies of Australia. Previously many interesting species had been described from that country, but they were all known merely as museum specimens and known only from bare systematic descriptions drawn mainly by writers in other lands. It is fortunate when the fauna of any land is studied on its own soil; but in the case of Australia it is especially fortunate because of the large number of archaic types there occurring, concerning which a more intimate knowledge has long been desirable.

Such knowledge has been furnished by Tillyard in a large measure; knowledge of life-histories and of habits, of ecology and distribution, of structure and development; and it is being published in a series of fruitful papers of so great value that every Odonatologist must wish that the series may long continue.

Two of these papers[1] deal with wing tracheation, and, like the others, are based on a large first-hand accumulation of facts. Especially valuable is the contribution to the knowledge of the development of the Cordulinae, a subfamily that is represented in Australia by many remarkable forms. But all the groups of the available fauna have been extensively drawn upon.

Tillyard's studies of tracheation extend and entirely corroborate my own[2] in so far as facts are concerned; but he offers a different interpretation of two matters: (1) the anal veins of the Anisoptera; (2) the radial sector of the Zygoptera. I desire to restate my views concerning these in the light of the new evidence and arguments he has produced.

Tillyard's interpretation of the anal region of the Anisopteran wing differs but little from my own. He found, as I did earlier, that the anal trachea is closely approximated to the cubital for a distance and then descends through an apparent cross vein; then bends again sharply outward and follows thereafter the direct course of the anal vein. He proposes to call the apparent cross vein the "anal crossing," and this I consider an excellent descriptive term and better than "basal cubito-anal cross vein," whether it were originally a cross vein or not; in one instance at least he has shown it is not the most basal of the series of cubital-anal cross veins. Tillyard would call the vein that forms about the conjoined portion of the cubital and anal tracheae Cu+A; and I see no serious objection to this, especially since he then disposes of the vein hitherto known as the anal by a device so little inconvenient as merely labeling it A.[3] It was not merely the thought

[1]Tillyard, R. J. On some problems concerning the development of the wing venation of Odonata. Proc. Linn. Soc. N. S. Wales 39: 163-216, 3 plates, 1914.

Tillyard, R. J. On the development of the wing venation in Zygopterous dragonflies with special reference to the Calopterygidae. Proc. Linn. Soc. N. S. Wales 40: 212-230, 6 text figures, 3 plates, 1915.

[2]Needham, J. G. A genealogic study of dragonfly wing venation. Proc. U. S. Nat. Mus. 26: 703-764, 14 plates, 44 text figures, 1903.

[3]In his studies of tracheation of the Chrysopidae (Proc. Linn. Soc. N. S. Wales 41 : 221-248, 1916), Tillyard also uses this simple device most opportunely to obviate a cumbersome terminology when apparently simple and direct veins are variously compounded. The condition there pointed out was previously noted by McClendon (Ent. News 17: 120, 1906).

of an encumbered terminology, however, but a doubt as to real homologies of the vein that kept me from doing something like this earlier. I found that the anal trachea originates in the position of the straight adult vein, and only later in development moves up against the cubital, becoming twice angulated. I found the extreme base of the wing saclike and open, its membranes tardily fusing to delimit the vein cavities; and it was easy to conceive that a small marginal trachea, like the anal, occupying a constricted place at the base of the wing might have slipped over where there was obviously more room; and there was and is much doubt in my mind as to whether the vein ever went along with the trachea. This doubt was not resolved by reading Tillyard's paper, for he brings in no new evidence whatever, and I have not his confidence in the constancy of the tracheae. However, Professor Comstock, on reading his paper, set about it and found some new evidence. He reasoned that if the base of the so-called anal vein be a secondary development, some fossil form, if primitive enough, might show its absence. At once he found a single figure of a fossil *Aeschna liassina* of Brodie, which shows this condition. At least the drawing as offered by Brodie[4] and copied by Handlirsch[5] shows it. In other parts of the wing, however, this drawing shows obvious inaccuracies. Wherefore, I desired to have the facts confirmed; so I wrote Mr. Herbert Campion to request a re-examination of the specimen. He wrote at once that he though it was in the Warwick Museum, but on the 13th of May, 1916, he wrote again that it could not be found. Assuming the correctness of this detail of the figure, the best evidence now available seems, therefore, to be in favor of Tillyard's interpretation.

Tillyard's interpretation of the radial sector of the Zygoptera differs utterly and irreconcilably from my own. He found, as I did earlier, that the trachea corresponding to the radial sector is not attached to the radial trachea in any of the Zygoptera, but appears as an added branch of the median tra-

[4]Brodie. Fossil Insects of the secondary rocks of England, Pl. 10, Fig. 4.

[5]Handlirsch. Die fossile Insecten, Pl. 42, Fig. 1.

chea. If this trachea be conceived as a new development from the median stem, I see no particular objection to labeling it Ms; it it be the old original branch from radius that has found a new basal attachment it should still be labeled Rs; but the vein which follows it I cannot believe to be other than Rs of Anisopteran wings. As to the adult vein, I entirely agree with Mr. Campion in the opinion expressed in his letter of March 18th last when he said: "That the Zygoptera do not possess Rs at all is a rather startling proposition and hardly one which can be accepted offhand. In Zygopteran and Anisopteran wings alike we find six longitudinal veins to be all located between R and M. These veins occupy exactly similar positions in the two kinds of wings, and I find it exceedingly difficult to believe that they are to be interpreted in one way in the Zygoptera and in another way in the Anisoptera."

Tillyard demands ontogenetic evidence; and yet, singularly enough, in support of his "unbranched radius theory" he offers just the evidence I lacked to give me the greatest assurance in the other interpretation. This evidence is not from tracheae, however, but from cuticularization of the nymphal wing—a sort of evidence which he himself stresses heavily in support of his theory concerning the development of the anal area of the wing. This cuticularization (anticipatory venation) of the nymphal wing he shows in his text Fig. 5 (Proc. Linn. Soc. N. S. Wales, 40; 227). This shows an actual crossing, for which Dr. Ris' statement that it is "preparatory to the development of the imaginal venation" is no explanation whatever. There is nothing like it in insect wings, except in oblique veins where tracheae either are present or have been present in earlier stages of development. This crossing follows exactly the course taken by the trachea Rs in the more generalized Anisoptera and is probably the channel which that trachea once occupied. It is for me a most satisfactory confirmation of the identity of the vein Rs of the two suborders of Odonata.

Such differences of interpretation grow out of different

ideas as to how the tracheation should be used as an aid to determining the homologies of veins. The tracheation of a nymphal insect wing is never identical with the venation of the adult wing. It may correspond closely; it may entirely diverge. Tracheation affords complete confirmation of vein homologies in some of the lower orders, such as Plecoptera and Corrodentia; it is worthless for such use in other orders, such as Trichoptera and Diptera. It is an aid in most orders, but needs to be used with discretion and with a regard to its limitations. The interpretation of vein homologies by the study of the antecedent tracheae is a method which, like most other methods that we use in zoology, is of value only for what it shows. It is not all-sufficient. Let any one who is inclined to trust to tracheation too far read Miss Morgan's study of Mayfly tracheation[6] and learn caution.

The Odonata are not alone in furnishing examples of the replacement of one principal tracheal branch by another, independent of adult venation. In explanation of its occurrence in the Zygoptera in my paper of 1903[2] (p. 713), I cite the parallel well known case of the attachment of trachea M1 to the radius in *Pieris*, a shift of tracheae which has never led Lepidopterists to change the designation of the adult vein. Indeed Tillyard himself is not consistent; for in the second of the two papers here under consideration he labels and discusses as branches of A, certain tracheae that spring from the cubital stem! If branches of the anal trachea may be shifted without disturbance of the adult vein, why may not those of the radial?

Fortunately, sufficient comparative study will enable one to learn when such shiftings have occurred, so that even in specialized groups the testimony of the tracheae is not wholly invalidated. But if we proceed to change the designation of adult veins without first learning this we shall create for ourselves intolerable and unnecessary confusion.

[6]Morgan, A. H. Homologies of the wing veins of mayflies. Ann. Entom. Soc. Amer. 5 : 89-106, 6 text figures, 5 plates, 1912.

The Egg Laying Habits of a Back-swimmer (Hem.),

Buenoa margaritacea Bueno, and other biological notes concerning it.

By H. B. Hungerford, Cornell University, Ithaca, New York.

(Plate XIII)

After having read in the text-books on entomology that the eggs of back-swimmers are inserted in the stems of aquatic plants, it was a matter of some surprise to the writer when he was informed that such was not the case with those observed in America. In looking up the literature he very shortly discovered that the basis for the statement found in our texts was the fact that *Notonecta glauca,* common in France, was said by Regimbart (1874) to place its eggs in the "twigs and petioles of plants." In a paper entitled "Observations sur la Ponte du Dytiscus marginalis et de Quelques Autres Insectes Aquatiques," among the other aquatic insects he describes briefly the egg-laying habits of *N. glauca* and presents a figure of a stem containing the egg in situ, the cephalic end protruding from the stem.

This article, though not the first to mention the method of oviposition of *Notonecta glauca,* has been widely quoted. An examination of the earlier literature will disclose the fact that the species *N. glauca* must also sometimes glue its eggs to the stems of water plants. The diversity of statements regarding the habits in question is best shown by a review of the Bibliography at end of this paper, wherein are added quotations from some of the various texts from Roesel (1746) to the present time.

In 1896 Kirkaldy exhibited the ova of *Notonecta glauca* var. *urcata* before the Entomological Society of London and, after quoting Regimbart, made the following remarks: "The specimens before you, owing probably to the absence of rushes (*Juncus*) in the vessel, although *Anacharis,* which one would have thought suitable, was in abundance, are entirely external, affixed basally to the stalk by a glutinous substance, as in the allied Corixidae. That this basal fixation is not usual is evident from the fact that the ova are but feebly adherent, drop-

ping off upon a slight disturbance, whereas the ova of the Corixidae are attached exceedingly firmly."

In 1902 Mr. J. R. de la Torre Bueno called attention to the fact that *N. undulata* female does not make a slit in the epidermis of the leaf or stem, but merely glues the eggs along the sides in a rather irregular fashion on the surface. In his paper on "The Genus *Notonecta* in America, North of Mexica, 1905," he states that out of some 1300 or 1400 ova of four or five species observed, in all but one instance* were the eggs attached to submerged plants or twigs.

Christine Essenberg (1915), in her studies on the habits and natural history of the back-swimmers, reports that the four species with which she worked at Berkeley, California, namely, *Notonecta undulata* var. *charon, N. insulata,* Kirby, *N. indica* and an undescribed species, all attach their eggs to the stems of plants, as noted by Mr. Torre Bueno, and even to the backs of other insects, such as dragon fly nymphs. It would seem probable then that in the case of all of our American species of this genus, the eggs as a rule are attached to the surface of their support.

Thus a diversity in habits of oviposition between the common European form, as reported by Regimbart, and our own species has been a matter of some interest, and it may add a trifle to our appreciation of the American back-swimmers to note that among them in the genus *Buenoa* is one which, with more parental concern than is evinced by even the European *glauca,* embeds its ova in the stems of water plants.

At this point it may be well to recall that there are three genera of the family *Notonectidae* in America north of Mexico. They are *Notonecta, Buenoa* and *Plea,* which are represented by 12, 3 and 1 species, respectively. These may be separated by the following table, wherein is included a key to the species of the genus *Buenoa.*†

A. Legs all similar ..... *Plea* Leach.
A.A. Legs dissimilar, hind legs flattened and fringed for swimming.

*This one instance was a case of *N. undulata* female which placed her ova quite deeply in the stem of a water weed.

†Adapted from Bueno (1905) and (1909) and earlier workers.

B. Last joint of antennae much shorter than penultimate,
Notoncctа Linn.

B.B. Last joint of antennae longer than the penultimate.
Buenoa Kirk.

C. Large species over 6 mm. long.....*B. margaritacea* Bueno

C.C. Smaller species less than 6 mm. long.

D. Eyes large and prominent; shape slender.
B. platycnemis Fieb.

D.D. Eyes large but not prominent—shape more convex,
B. elegans. Fieb.

Of these three genera it has long been known that the tiny *Plea* places its eggs out of harm's way in the stems of the aquatic plants. The observations have been for the European *P. minutissima* Leach, but the same is doubtless true in the case of our own *Plea striola*, for the female possesses the necessary equipment for such a task.

All American members of the genus *Notoncctа,* at least those that have been observed, attach their eggs by their long axis to stems of plants, submerged brush wood and the like. The egg of *N. undulata,* our commonest species, is shown in Fig. 7, Pl. XIII.

It is a pleasure to report some observations on the oviposition of the female of one species of the genus *Buenoa,* which is endophytic in this habit.

After futile attempts to obtain the eggs in the aquarium which, it was supposed, would be deposited on the twigs placed therein for the purpose, an examination of the female's equipment for oviposition disclosed the device shown in Plate XIII, Fig 9.

With this clue, the pond was visited at once and quite fortunately the first object examined was literally full of the same sort of ova which had been noted in the bodies of the bugs. It was an uprooted smartweed (*Polygonum*) floating in the pool some fifteen feet from shore. Not only were the stems of this green bit of smartweed swollen and distorted* by the many eggs it contained, but the leaves also were em-

* Stem of smartweed 23 ova crowded in linear space of one centimeter.

ployed as *nidi* with varying degrees of success. The leaves were punctured and the egg, when present, rested suspended beneath, attached by the collar shown in the drawing Pl. XIII, Fig. 1, to the upper surface margins of the incision. The many perforations or slits through the leaves gave their testimony to the many failures in attempting to employ so thin a structure for nidification.

Subsequently eggs have been found in floating *Typha* and *Juncus* and have been deposited in the aquarium in the tissues of both of these plants.

The drawings give perhaps a better idea of the eggs and young larvae than a description, but the following are submitted for the purpose of their precise recognition.

The Ovum.

Size: 1.125 mm. long by .406 mm. in its widest diameter. The size increases somewhat with the development of the embryo within, which causes a bulging of the stem in which the egg is inserted.

Shape. The egg is an elongate oval when seen in surface view with the cephalic end the more pointed. (Surface view = the side, a portion of which is exposed to view as the egg lies imbedded in the stem.) In lateral view it appears nearly straight in the outline of its upper surface while the lower is quite strongly curved.

Color. Pearly white when first laid—the surface hexagonally reticulate as in the eggs of *Notonecta.* A smooth and shiny elongate oval area occupies the anterior half of the upper surface. This is the portion exposed and is margined by a whitish band which marks the union of the egg with the surface of the stem when *in situ.* As the embryo develops, the entire egg becomes deep greyish yellow and the red eye spots and other red markings show through the chorion. The part exposed becomes dark amber in color and very shiny in appearance. The surface appears reticulate under magnification.

First Instar Nymph.

Size (in millimeters): body length 1.85, body width .625, head width .5, distance between eyes .156. Fore limb: femur .25, tibia .35, tarsus .25 mm. Middle limb .387, .333 and .275 and hind limb .625, .630 and .625 for femur, tibia and tarsus respectively.

Color. Ventral aspect: White—the abdominal fringe of hairs, the ventral abdominal tuft, the hair tufts before the hind coxae and those of middle coxae—black. The hairs fringing the hind tarsi are smoky black as are the middle and fore tibia. Eyes dark red. No indication

of the red pigment in the abdomen so conspicuous in older nymphs and adults. White with the red eyes—the only conspicuous marking.

Structural details: The absence of the median abdominal carina from the venter, as is the case also with *N. undulata* nymphs, is the first and most striking peculiarity. The interspace between the eyes is large. Beak four-jointed as in adult. Tarsi all one-jointed, terminating in two claws. The spiny armature of fore legs is more generalized than in later forms. The fringe of the hind legs confined to the margins of the tarsi.

The Older Nymphs.

In order that space may be conserved, a table of measurements for the various instars is presented below and a discussion of the changes in structure as development proceeds appended.

Measurements in Millimeters of Nymphs of *B. margaritacea*.

Instar	Body Measurements			Leg Measurements								
	Length	Width	Width head	Fore Leg			Middle Leg			Hind Leg		
				Femur	Tibia	Tarsi	Femur	Tibia	Tarsi	Femur	Tibia	Tarsi
1st	1.85	.625	.5	.25	.35	.25	.387	.333	.275	.625	.63	.625
2nd	2.25	.702	.625	.375	.438	.313	.5	.438	.375	.75	.76	.81
3rd	3.225	.938	.832	.5	.62	.487	.75	.625	.6	1.1	1.1	.975
4th	4.5	1.625	1.063	.625	.75	.563	1.063	.875	.725	1.625	1.375	1.28
5th	5.75	2.3	1.365	.8	1.2	.81	1.5	.625	1.125	2.25	1.85	1.6
6 ♂	7.*	2.2	1.62	1.	1.35	1.	1.75	1.37	1.25	2.5	2.35	1.95
6 ♀	7.5	2.2	1.75	1.	1.5	1.	2.	1.5	1.3	3.	2.62	2.3

The adults of this species are separated in the synoptic table from the other two species on the basis of the body length, which is greater than 6 mm. This, with a diagnosis of the instars from structural characters, may serve to separate the nymphs of this species from those of the others. The table of measurements above is based on an average of ten specimens of each instar. A larger number would be desirable to obtain figures dealing with ratio of growth. The writer believes that an examination of a sufficiently large amount of material would show for head-widths and limb measurements a ratio of 1 :1.25. That is to say, the width of the head of the

* Bueno gives length of species 6.7–8.1, lat. 2.23 mm.

second instar nymph would be approximately 1.25 times that of the first instar nymph.

Upon attaining the adult stage a sexual dimorphism becomes apparent. Besides the structural differences of the genitalia, the anterior legs of the male possess on the inner faces of the femora and tibia peculiar stridular areas.

The tibial structure is borne on the inner face of a prominence, which is formed by the elevation of the inner angle or margin of the tibia near its base into a thin but elongate spur. This spur is lacking in the female and not discovered in the nymphs. (See pl. XIII, Figs. 5 and 6.)

The Developmental Changes.

Head. The notocephalic margins of the eyes which are near together and nearly parallel in the adult are relatively much farther apart in the first instar nymph. In the newly hatched bug, the distance at synthlipsis is nearly 1-3 (one-third) width of head with the margins of the eyes diverging broadly to the vertex. As the development proceeds from instar to instar the eyes are brought nearer and nearer to their relations in the adult where the synthlipsis is reduced to about 7.14% of the width of the head.

The beak is four-segmented and the antennae of the nymphs have much the form of those in the adults.

Legs. The general form as in the adult. The tarsi of all the legs one-segmented and terminated by two claws. (The tarsi of the adults are two-segmented and end in two claws.)

Wings. The wing-pads are very inconspicuous even in the later nymphal instars. By the *third instar* the pads appear on the antero-ventral margins of the mesothorax as little flaps, the distal ends of which reach a position on a line with the trochanter of the fore leg when flexed. In the *fourth instar* they are much larger, the apices attaining to a position on a line with the distal end of the mesothoracic tibiae when the limb is flexed. In the *fifth instar* they are still closely applied to the side of the thorax, but the tips of the more opaque pads reach a point on a line with the distal ends of the hind coxae.

Habits of the Species.

Buenoa margaritacea is the common representative of its genus in the ponds and pools of eastern Kansas. It appears to prefer the open water and is in much better equilibrium in its watery world than the *Notonectae.*

Individuals of this species may be seen in large numbers

swimming slowly or even poising in mid-water some distance beneath the surface. They abound in waters teeming with *Entomostraca,* upon which they largely feed, the crib formed by the closure of the anterior two spiny pairs of legs being nicely adapted to the retention of such prey. Their dexterity in the manipulation of this device and its efficiency in retaining small beings may be demonstrated quite readily under the binocular, and affords another of nature's illustrations of the fitness of form to function.

Like others of the predatory class of water bugs they do on occasion fall upon corixids and other forms than the entomostraca, but not with the regularity of many of the others.

Adults appear from early spring to late fall. The eggs may be found in May, the nymphs begin to emerge by the middle of the month and by the 15th of June form a dominant species to be noted in all stages of development from egg to adult in waters suitable to their needs.

They are wilder and more difficult creatures to rear than the *Notonectae*, but no less interesting objects of study. So far as the writer is aware there has been nothing noted hitherto concerning their biology and he is glad to record for them something of the economy of their lives.

Annotated Bibliography.

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de Geer, Baron Karl. 1778. Abhandlungen zur Geschichte der Insekten....Nürnberg, Vol. 3, p. 254. (". . . . das Weibchen legt viele weisse länglich ovale Eier, gemeinlich an die Stiele and Blätter der Wasserkräuter.")

Glover, Townsend. 1876. Manuscript Notes on Hemiptera. (Quotes Ballot—A Mexican species of Notonectid lays eggs on water plants.)

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Howard, L. O. 1901. The Insect Book, p. 275. (Eggs in the stems.)

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Id. 1904. Uber Notonectiden, II Teil in: Wien. Ent. Zeit. 1904, p. 120. (Herein is created the genus *Buenoa* for American forms hitherto treated under *Anisops.*)

Kuhlgatz, Th. 1909. Rhynchota in: Brauer. A. Die Süss-wasserfauna Deutschlands. Heft. 7, p. 81. (*N. glauca* "Die Eier werden in Mehrzahl und zu einer Scheibe angeordnet an Stengeln und Blättern von Wasserpflanzen abgelegt. Hierzu verankert sich das female mit dem 1. Beinpaar und dem eingebohrten Rüssel an der Pflanze, in deren Parenchym es jedes Ei zu 2-3 einschiebt.")

Lampert, K. 1899. Das Leben der Binnengewässer. Leipzig. (Page 143 quotes Regimbart.)

Lefroy, H. Maxwell. Indian Insect Life. Calcutta and Simla. (Eggs are said to be inserted in the Stems.)

Miall, L. C. 1895. Natural History of Aquatic Insects, London. (Page 359, quotes Regimbart.)

Nowrogee, D. 1911. Life histories of Indian Insects II. Some aquatic Rhynchota and Coleoptera in: Memoirs of the Department of Agriculture in India, Vol. II, No. 9. Ento. Ser. Pusa. (Eggs of *Enithares indica* Fab. laid on stems and leaves of aquatic plants.)

Olivier, M. 1811. Encyclopédie Methodique. Histoire Naturelle des Insectes Paris. (Quotes De Geer, which see.)

Packard, A. S. 1869. Guide to Study of Insects. 9th ed. 1899. (On page 536 quotes Roesel 1746, who says *Notonecta* eggs are laid on the stems.)

Id. 1881. Half Hour Recreations in Natural History. Boston. (Ch. 6: p. 129. N. eggs on stems and leaves.)

Regimbart, M. 1875. Observations sur la ponte du *Dytiscus marginalis* et de Quelques autres Insectes Aquatiques in: Ann. Soc. Ent. Fr. (5) V. pp. 204-205.

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Schmidt-Schwedt, E. 1891. Schnabelkerfe in: Zacharias, Tier und Pflanzenwelt des Süsswassers. Vol. II, p. 113. (*N. glauca* lays its eggs on plants.)

Sharp, David. 1899. Cambridge Natural History. Insects, Part II. (On pg. 567 quotes Regimbart.)

Taschenberg, E. L., 1884. Die Insekten. Leipzig. (Page 602. Concerning *N. glauca*: "Mit Beginn des Frühjahres legen die Weibchen ihre ovalen, hellgelben Eier an den unteren Theil einer Wasserpflanze oder auf den Boden indem sie dieselben reihenweise zu einer Scheibe aneinander kleben.")

Wefelscheid, H. 1912. Ueber die Biologie und Anatomie von *Plea minutissima*. Zoologische Jahrbücher, Jena, XXXII, pp. 387-474. (See pages 396-401 and fig. D., p. 399.)

Westwood, J. O. 1839-40. An Introduction to the Modern Classification of Insects, 2 Vols., London.

Explanation of Plate XIII.

All the figures refer to *Buenoa margaritacea* unless otherwise stated.

Fig. 1. Egg removed from the stem showing the clear exposed area of the egg and its margin of white.

Fig. 2. Eggs in situ in stem of *Juncus*.

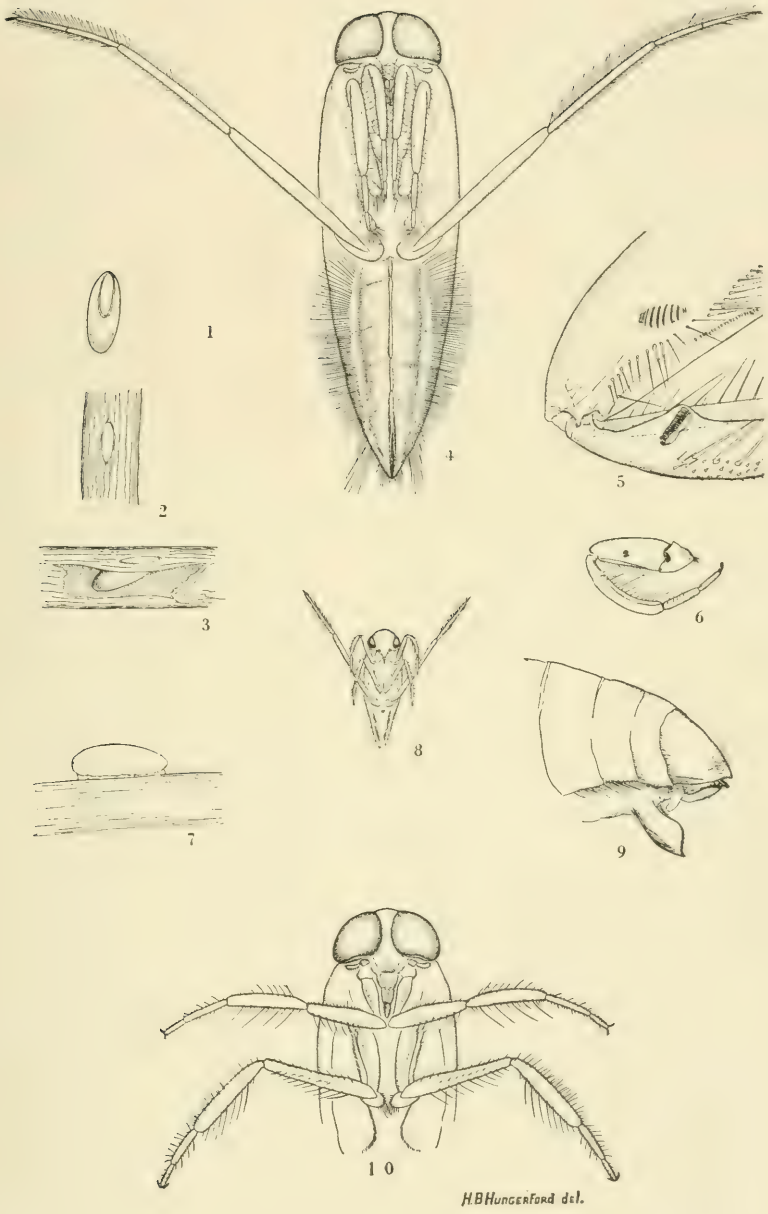
Fig. 3. A portion of the stem of *Juncus* removed to show the egg in situ.

Fig. 4. Ventral view of the female showing the appearance of the ovipositor and the crib formed by the two anterior pairs of legs for the retention of entomostracans. Compare with figure 10.

Fig. 5. Inner view of the stridular areas on the femur and tibia of the anterior leg of the male, greatly enlarged from figure 6.

Fig. 6. Inner view of the anterior leg of male showing the tibial prominence and stridular areas.

Fig. 7. Eggs of *Notonecta undulata* glued to the stem of aquatic plant. Drawn from a photograph.



BUENOA MARGARITACEA—HUNGERFORD.

Fig. 8. Newly hatched *B. margaritacea.* Note distance between the eyes, the absence of ventral abdominal plate and the fact that the tarsi are one-segmented.

Fig. 9. Lateral view of the terminal segments of the female showing the ventral plate drawn to expose the strongly dentated and chitinized ovipositor, by means of which incisions are made for the reception of the eggs in the tissues of plants.

Fig. 10. Compare with figure 4. The anterior legs spread to show the concavities of the limbs and their spiny armature.

A New Species of Acronycta (Lep.).

By Otto Buchholz, Elizabeth, New Jersey.

Acronycta wanda n. sp.

Ground color a uniform, very dark smoky grey. Head blackish above. Thorax without markings save the usual black line from the palpi to the base of the wings.

Primaries with all the markings fairly well defined. Basal line geminate, extending to basal dash. Transverse anterior line geminate, outwardly oblique, the inner line a little more strongly defined than the outer, especially from costa to basal dash. A very feeble median shade runs obliquely from costa to reniform. The transverse posterior line is geminate, the inner line very faint, the outer line black, lunulate, the intervening space paler than the ground color. A diffusely lunulate, interrupted whitish subterminal line. A dusky terminal line with larger interspacial dots, beyond which is a dusky interline in the fringes; the latter are whitish and cut with black. In fresh specimens the dots of the terminal line extend as fine black lines to the subterminal line. The basal streak, which in some specimens is bordered with white above, is heavy and extends to the outer portion of transverse anterior line and sometimes a little beyond. A fine dagger mark opposite the cell runs a trifle beyond the t. p. line. A similar mark in the submedian interspace also crosses the t. p. line and is much heavier than the other. All veins are marked blackish on outer half of wing. The orbicular is small, concolorous, black-edged, irregular and usually complete. Reniform kidney-shaped, moderate in size and sometimes darkened inferiorly. The two spots are connected by a black line.

Secondaries smoky in both sexes. Beneath whitish, primaries a little darker than secondaries, with the usual outer line and discal spots.

Expanse, 1.65-1.90 inches (42-48 mm.)

Habitat Union County, New Jersey, beginning of June and August. Four males and one female have been under examination. This species belongs in the *lobeliae* group and suggests *furcifera* in structure and ornamentation, but it is much darker, almost black, and the prominent marked veins serve to separate the two. In recognition of the persistent work in this group done by my wife, I dedicate this species to her *Type* a male in the author's collection. A male co-type in the collection of F. Lemmer, Irvington, New Jersey.

The New Head of the Department of Zoology and Entomology, Ohio State University.

Professor Raymond C. Osburn, of the Connecticut College, New London, Connecticut, has been elected Head of the Department of Zoology and Entomology of the Ohio State University, his appointment to take effect July 1st. He will assume the duties carried during the last nineteen years by Dr. Herbert Osborn, who was last year elected Research Professor and who will hereafter give his entire time to research work, including a direction of research work by graduate students, and, for the present, the Directorship of the Lake Laboratory and of the Ohio Biological Survey.

Dr. R. C. Osburn graduated from the Ohio State University in 1898, received a Master's degree from the same institution in 1900, and the Ph.D. degree from Columbia in 1906. He has been connected as a teacher with the Starling Medical College, Columbus, Ohio; Fargo College, Fargo, North Dakota; Clinton High School of Commerce, New York City; Barnard College, Columbia University, and the Connecticut College, in which he is now Professor of Biology.

Dr. Osburn is known to entomologists as the author of a number of papers on Syrphidae and Odonata and he was for several years President of the New York Entomological Society. He is much interested in the ecology of aquatic insects, but his main work has been upon aquatic invertebrates and fishes.

Adult Chrysopidae Do Eat (Neur.).

I was very much interested in the Notes on the Feeding Habits of Adult Chrysopidae, by L. Bradford Ripley, in the January, 1917, number of Entomological News.

By actual observation I can indorse Prof. Ripley's statement that Chrysopidae take food in the adult stage. While my observation was of short duration and of a single specimen, it proved beyond a doubt that these insects are far from being abstinent. On the evening of September 19th, 1916, an adult Lace-winged fly was captured and the next morning, having just finished eating a juicy pear, I had occasion to examine this specimen which was in a stupid condition, as I now believe for the want of food.

No sooner had I taken it into my hand than it began to gnaw at my fingers, which were yet moist with the juice of the pear. Taking a tip from this, I sprinkled some granulated sugar on my hand which it ravenously ate.

Through a hand-glass we saw grain after grain quickly disappear, and this little creature did not content itself to feed among the scattering grains, but waded into the thick of the sugar. This specimen was placed back in the jar with some sugar and water where it remained until the next morning when I took it from the jar to feed it some more pear juice.

When placing it on my hand, as I had the day before, I found to my disappointment that I did not have the little pet that I thought I had, for it briskly flew away, showing that the gentleness of the day before was caused by hunger. After finding that these insects feed on sugar and fruit juice I have but little doubt about their feeding on the natural sweets of flowers and plants.—Wilton T. Goe, Portland, Oregon.

ENTOMOLOGICAL NEWS.

PHILADELPHIA, PA., APRIL, 1917.

Ants vs. Men.

The President's address before the Geological Society of America at Albany, December 28, 1916, printed in *Science* for February 9, 1917, contains some remarks interesting to the entomologist which the latter would hardly look for in a discourse entitled "The Philosophy of Geology and the Order of the State." The speaker, distinguished and honored for his many contributions to his science, "wish[es] to nail [certain theses] on the doors of our temple" of geology. Among them are

> Nature makes for the individual . . . In the progressive line of development which in the present terminates in us, the procedure of nature has been one of only limited concern for the family and of tried out and abandoned experiment for social partnerships and the division of labor.

A lively account of the "six-legged articulate expression of existence" which "has led to most extraordinary displays of morphological and psychic differentiation," culminating in the ants, "nature's great triumph, her highest performance in communistic effort and in co-operative achievement," is brought to the astonishing conclusion that

> The six-legged type with all its purposes, in its highest expression lies prostrate on the ground at our feet, it and its achievements have risen to nothing higher than an ant hill, its communistic relations and subservience are entirely apart from the true genius of humanity . . . For the former the student of nature's history sees no outcome.

We say astonishing, for, while we are well aware that the anthropocentric conception of the universe still permeates the

great mass of humanity, we thought that scientific men at least were able to throw off the egotism of their own species and look at nature from a detached standpoint. We can as little foresee that there will be no outcome for the ants as Cuvier was able to foresee the downfall of his law of correlation of parts. With the human species at the present time engaged in an almost universal attempt to destroy itself, it is farcical to talk of its "active, progressive and fertile individualism," while the success of Argentine, leaf-cutting and other ants throughout the world, despite human objections, gives one a sufficient basis for expecting as long a continuance of these pertinacious insects on the earth as of the, one would like to say, satirically named *Homo sapiens*.

The Host of Ablerus clisiocampae Ash. (Hym.).*

The following note is in corroboration of the observations made upon the host of *Ablerus clisiocampae* Ash. by L. T. Williams. (Psyche, October, 1916.)

In the spring of 1915, the writer bred several specimens of *Ablerus clisiocampae* from the eggs of *Malacosoma americana* Fab., but at the time was unable to make sure that the parasite had not emerged from a scale insect, although it hardly seemed possible. In the spring of 1916, after a few specimens of *Ablerus* had appeared, a number of egg masses were taken from the twigs, and thoroughly examined for the presence of scale insects, but none were present. With all possible chance of the presence of scale insects thus eliminated, the parasites continued to emerge from the egg masses in fair numbers. A repetition of the experiment gave the same result.

These observations corroborate those made by Williams and the original ones made by Ashmead, that this species, contrary to the habits of the family to which it belongs, does at least at times parasitize the eggs of a Lepidopterous insect.

In addition to *Ablerus clisiocampae*, three other species of parasites were bred from the egg masses. They were kindly determined for me by Mr. A. A. Girault as *Telenomus coloradensis* Crawford, *Tetrastichus malacosomae* Girault, and *Ooencyrtus* sp. Of these, *Tetrastichus malacosomae* was by far the most abundant, the other two species being only occasionally found.—B. A. Porter, Amherst, Massachusetts.

*Contribution from the Entomological Laboratory, Massachusetts Agricultural College.

Entomological Literature.

COMPILED BY E. T. CRESSON, JR., AND J. A. G. REHN.

Under the above head it is intended to note papers received at the Academy of Natural Sciences, of Philadelphia, pertaining to the Entomology of the Americas (North and South), including Arachnida and Myriopoda. Articles irrelevant to American entomology will not be noted; but contributions to anatomy, physiology and embryology of insects, however, whether relating to American or exotic species, will be recorded.

The numbers in **Heavy-Faced Type** refer to the journals, as numbered in the following list, in which the papers are published.

All continued papers, with few exceptions, are recorded only at their first installments.

The records of papers containing new species are all grouped at the end of each Order of which they treat. Unless mentioned in the title, the number of the new species occurring north of Mexico is given at end of title, within brackets.

For records of Economic Literature, see the Experiment Station Record, Office of Experiment Stations, Washington. Also Review of Applied Entomology, Series A, London. For records of papers on Medical Entomology, see Review of Applied Entomology, Series B.

1—Proceedings, Academy of Natural Sciences of Philadelphia. **2**—Transactions, American Entomological Society, Philadelphia. **4**—The Canadian Entomologist. **10**—Nature, London. **37**—Le Naturaliste Canadien, Quebec. **50**—Proceedings, U. S. National Museum. **68**—Science, New York. **42**—Journal, Linnean Society (Zoology), London. **87**—Bulletin, Societe Entomologique de France, Paris. **143**—Ohio Journal of Science, Columbus, Ohio. **153**—Bulletin, American Museum of Natural History, New York. **161**—Proceedings, Biological Society of Washington. **184**—Journal of Experimental Zoology, Philadelphia. **198**—Biological Bulletin, Marine Biological Laboratory, Woods Hole, Mass. **223**—Broteria, Revista de Sciencias Naturaes do Collegio de S. Fiel. (Ser Zoologica). **235**—Memoire, R. Accademia dei Lincei, 5th series, Roma. **237**—University of Colorado Studies, Boulder. **240**—Maine Agricultural Experiment Station, Orono. **283**—Bulletin, Societe Zoologique de France, Paris. **284**—Bulletin, Museum National d'Histoire Naturelle, Reunion Mensuelle des Naturalistes du Museum, Paris. **307**—Annales, Societe Linneene de Lyon (n. ser.). **324**—Journal of Animal Behavior, Cambridge. **379**—Proceedings of the International Zoological Congress. **480**—The Annals of Applied Biology. **490**—The Journal of Parasitology, Urbana, Illinois. **509**—Revue Generale des Sciences Pures et Appliquees, Paris. **532**—Proceedings, National Academy of Sciences of the United States of America, Washington. **538**—Lorquinia, Los Angeles. **546**—Illinois Biological Monographs, Urbana. **547**—Journal. The Franklin Institute, Philadelphia. **548**—Physis, Revista de la Sociedad Argentina de Ciencias Naturales.

GENERAL SUBJECT. **Cockerell, T. D. A.**—The fauna of Boulder Co., Colorado, III-IV. Diptera, etc., **237,** xvii, 5-25. **Dahlgren, U.**—The production of light by animals, **547,** 1917, 323-48. **Falcoz, L.**—Contribution a l'etude de la faune des microcavernes faune des

terriers et des nids, **307,** lxi, 59-246. **Jorgensen, P.**—Zoocecidios argentinos, **548,** ii, 350-65. **Labitte, A.**—Longevite de quelques insectes en captivite, **284,** 1916, 105-13. **Navas, R. P. L.**—Particularidades sobre las alas de los insectos, **379,** ix, 767-73. **Neveu-Lemaire**—Parasitologie des plantes agricoles [Paris, J. Lamarre, 1913], 720 pp. **Reed, E. B.**—Obituary notice, **4,** 1917, 37-9. **Stiles, C. W.**—Report of the international commission on zoological nomenclature, **379,** ix, 852-915. **Tavares, J. S.**—As cecidas do Brazil que se criam nas plantas da familia das Melastomataceae, **223,** xv, 18-49.

PHYSIOLOGY AND EMBRYOLOGY. C., G. H.—Sex-limited factors in heredity, **10,** xcviii, 479-80. **Foa, A.**—Studio sul polimorfismo unisessuale del Rhizoglyphus echinopus corredato da osservazioni biologiche...., **235,** xii, fas. 1, 109 pp. **Goldschmidt, R.**—On a case of faculative parthenogenesis in the gypsy-moth, with a discussion of the relation of parthenogenesis to sex, **198,** xxxii, 35-43. **Marshall & Muller**—The effect of long-continued heterozygosis on a variable character in Drosophila, **184,** xxii, 457-70. **Plough, H. H.**—Cytoplasmic structures in the male germ cells of Rhomaleum micropterum, **198,** xxxii, 1-12.

ARACHNIDA, ETC. Macnamara, C.—On the portrait of a wolf spider, **4,** 1917, 39-45. **Wheeler, W. M.**—The synchronic behavior of Phalangidae, **68,** xlv, 189-90.

Ewing, H. E.—New Acarina, Part II. Descriptions of n. sps. and var. from Iowa, Missouri, Illinois, Indiana and Ohio [28 new], **153,** xxxvii, 149-72. **Weidman, F. D.**—Cytoleichus penrosei, a new arachnoid parasite found in the diseased lungs of a prairie dog, **490,** iii, 82-9.

NEUROPTERA, ETC. Tillyard, R. J.—A study of the rectal breathing apparatus in the larvae of Anisopterid dragonflies, **42,** xxxiii, 127-96.

ORTHOPTERA. Foucher, G.—Etudes biologiques sur le Cyphocrania gigas d'Amboine, **509,** xxvii, 706-13. **Serre, P.**—L'Ile de la Trinite menacee d'une invasion de Sauterelles, **284,** 1916, 101-4.

Hebard, M.—Studies in the group Ischnopterites (Blattidae) [8 n. sps.], **2,** xlii, 337-86.

HEMIPTERA. Deletang, L.—Notas hemipterologicas, **548,** ii, 263-71. **Gibson, E. H.**—Additions to the list of Missouri Cicadellidae, **4,** 1917, 75-6. **Lizer, C.**—Sobre la presencia del Chrysomphalus paulistus, en el Delta del Parana; Ceroplastes grandis, nuevo para la fauna argentina, **548,** iii, 432, 438. **Osborn, H.**—Studies of life histories of frog-hoppers of Maine, **240,** Bul. 254. **Parshley, H. M.**—Insects in ocean drift, **4,** 1917, 45-48.

Drake, C. J.—A survey of the No. American species of Merragata [2 new], **143,** xvii, 101-5. **Lathrop, F. H.**—A preliminary list of Cicadellidae of So. Carolina, with descriptions of n. sps. [7 new], **143,** xvii, 119-131. **Shinji, C. O.**—The California species of Myzus with description of a n. sp.; A n. sp. of Amphrophora from California, **4,** 1917, 49-51; 51-2.

LEPIDOPTERA. Fox, C. L.—A few notes on a collecting trip around Palm Springs, Riverside Co., California, **538,** i, 49-51. **Giacomelli, E.**—Sobre una nueva aberracion de Cyanohipsa stefanellii, A proposito de una Pierida del genero Hesperocharis, **548,** ii, 293-295. **d'Herculais, J. K.**—Les sphingides du genre Acherontia, Lepidopteres mellivores parasites des abeilles, **284,** 1916, 17-49. **Mabille et Boullet**—Description d'Hesperides nouveaux, **87,** 1916, 320-5. **Pictet, A.**—Le role joue par la selection naturelle dans l'hibernation des lepidopteres, **379,** ix, 774-88.

Swett, L. W.—Geometrid notes: The genus Dysstroma [3 new], **4,** 1917, 64-72.

DIPTERA. Baumberger, J. P.—The food of Drosophila melanogaster, **532,** iii, 122-6. **Cole, W. H.**—The reactions of Drosophila ampelophila to gravity, centrifugation, and air currents, **324,** vii, 71-80. **Peterson, A.**—The head-capsule and mouth-parts of D., **546,** iii, No. 2, 112 pp. **Rennie, J.**—On the biology and economic significance of Tipula paludosa, **480,** iii, 116-37. **Szilady, Z.**—Vorlaufige mitteilung ueber eine Tabaniden-monographie, **379,** ix, 744-5.

Alexander, C. P.—New or little-known crane-flies from the U. S. and Canada: Tipulidae, Ptychopteridae, Pt. 3 [many new], **1,** 1916, 486-549. **Cockerell, T. D. A.**—A fossil tsetse fly and other diptera from Florissant, Colorado, **161,** xxx, 19-23. **Cresson, E. T., Jr.**—A revision of the species of the genera Notiphila and Dichaeta (Ephydridae) [13 n. sps.], **2,** xliii, 27-66. **Johannsen, O. A.**—New eastern Anthomyiidae [8 new], **2,** xlii, 385-98.

COLEOPTERA. Brethes, J.—Sobre la variabilidad de algunos Crisomelidos: cosa de "Chalcophana lineata"; Description d'un nouveau genre et d'une nouvelle espece de Staphylinidae myrmecophile; Descripcion de un neuvo Carabido de la R. Argentina, **548,** iii, 424; 431-2; 464-5. **Bruch, C.**—Descripcion de un nuevo Tenebrionido del Chubut Calymnophorus patagonicus, **548,** ii, 292-3. Miscelaneas coleopterologicas, **548,** iii, 456-61. **Ford, G. H.**—Observations on the larval and pupal stages of Agriotes obscurus, **480,** iii, 97-115. **Frers, A. G.**—Variabilidad en la coloracion de un Crisomelido de la provincia Buenos Aires, Lema orbignyi, **548,** iii, 433-5. **Gallardo, A.**—El mirmecofilo sinfilo Fustiger elegans, **548,** ii, 254-7. **Germain, F.**—Histerides d'Ottawa et des environs, **37,** xliii, 125-8 (cont.). **Houlbert, C.**—La loi de la taille et l'evolution des coleop-

teres, **379,** ix, 699-742. **Leng & Mutchler**—Supplement to preliminary list of the C. of the West Indies, **153,** xxxvii, 191-220. **Lesne, P.**—Notes sur les coleopteres terediles. Variabilite de certains Lyctides de l'Amerique du Nord, **284,** 1916, 92-100. **McDermott, F. A.**—Observations on the light emission of American Lampyridae, **4,** 1917, 53-61. **Pic, M.**—Nouveaux malacodermes exotiques, **283,** xl, 95-7. **Xambeu, C.**—Moeurs et metamorphoses des insectes, 16 memoire, **307,** lxii, 25-42.

Blanchard, F.—Revision of the Throscidae of No. America [7 n. sp.], **2,** xliii, 1-26. **Fall, H. C.**—Short studies in the Malachiidae [24 n. sps.], **2,** xliii, 67-88.

HYMENOPTERA. Brethes, J.—Un caso anormal en "Polistes canadensis" var. "Ferreri"; Le genre "Xylocopa" dans la Republique Argentine, **548,** iii, 423; 407-21. **Carpenter, G. H.**—The scarcity of wasps, **10,** xcviii, 413. **Kojewnikov, G.**—Sur les abeilles hermaphrodites, **379,** ix, 743. **Santschi, F.**—Formicides sudamericains nouveaux ou peu connus, **548,** iii, 365-99. **Stoehr, L. M.**—"Microbembex monodonta," **37,** xliii, 113-19 (cont.). **Wheeler, W. M.**—The phylogenetic development of subapterous and apterous castes in the Formicidae, **532,** iii, 109-17.

Brues, C. T.—Adult hymenopterous parasites attached to the body of their host [1 new sp.], **532,** iii, 136-40. **Mickel, C. E.**—New sps. of H. of the superfamily Sphecoidea [many new], **2,** xlii, 399-434. **Parker, J. B.**—A revision of the bembicine wasps of America, north of Mexico [some new], **50,** lii, 1-555.

Check List of Lepidoptera of Boreal America. By Wm. Barnes, S.B., M.D., and J. McDunnough, Ph.D. Decatur, Illinois, February, 1917. Published under the patronage of Miss Jessie D. Gillett, Elkhart, Indiana.

It has been thirteen years since we have had a list of North American Lepidoptera and, as the authors say, many new species have been described and revisions made in many groups and also changes in classification. Such a list is always useful, as far as it goes, and the present one has brought the Lepidoptera up to the present state of our knowledge. Six hundred and sixty-one species of Rhopalocera are listed as compared with six hundred and ninety-eight listed by J. B. Smith in 1903. This difference is due to some of them being reduced to the synonymy and others being considered varieties or aberrations. The genera used are more in harmony with common sense than as hitherto used by some persons, but of course there is much to be done to place them on a firm foundation. Eight thousand

four hundred and ninety-five species of moths are listed, whereas Smith's list went to seven thousand, one hundred and sixty-nine, an increase of one thousand, three hundred and twenty-six. This is a very considerable increase, and while there will be still more species of moths described, there will also be a considerable reduction by synonymy, varieties and aberrations, as the genera are revised and the relationships of the species better known. It goes without saying that other students will not agree in all cases with the authors in regard to the standing of the species, but that is to be expected, as such a work always shows a certain amount of personal opinion. Taking it as a whole the authors have been conservative. The complete index is valuable. We find nothing to condemn and much to praise, and trust that those persons for whom the work has been prepared will be duly appreciative.—H. S.

Doings of Societies.

Feldman Collecting Social.

Meeting of December 20th, 1916, at the home of H. W. Wenzel, 5614 Stewart Street, Philadelphia; twelve members present. President H. A. Wenzel in the chair. Prof. J. G. Sanders, State Zoologist of Pennsylvania, elected an honorary member.

Lepidoptera. Mr. Daecke mentioned that a Mr. Anderson had found larvae of *Vanessa antiopa* Linn. on willow along the Susquehanna River, at Harrisburg, Pennsylvania, from which was reared one, on September 1st, that has a yellow band covering the outer half of wings; this was exhibited and is var. *hygiaea* Heg.; he stated that the only record he knew of this "freak" is in Holland's *Butterfly Book*, p. 169, pl. xx', fig. 4, 1910.

Coleoptera. Mr. H. W. Wenzel exhibited his rearranged collection of Colydiidæ and Cucujidæ. Dr. Castle exhibited two specimens of *Pelecomus obscurus* LeC. from Detroit, Florida, October 15; a species with very peculiar antennæ; he also has it from Savannah, Georgia. Mr. Wenzel said all his specimens are from Texas. Dr. C. also reported breeding *Callidium antennatum* Newm. from the larvae in logs brought to the meeting of September 20th by Mr. Hoyer. Mr. Laurent, quoting from an article published in *Science* of November 17th, 1916, entitled "The Synchronal or Simultaneous Flashing of Fireflies," stated that he did not believe any such occurrence ever took place, that it was nothing but the twitching of the observer's eyelids. Some years ago he saw what he thought to be a case of simultaneous flashing of fireflies (Lampyridæ); however, he soon discovered it was nothing but the twitching of his eyelids that caused the effect and the insects had nothing whatever to do with it. Adjourned to the annex.

Geo. M. Greene, *Secretary.*

Entomological Section, The Academy of Natural Sciences, Philadelphia.

Meeting of January 25, 1917. Eleven persons present. Director Philip Laurent presiding.

Dr. Calvert exhibited specimens of some of the more striking insects which Mrs. Calvert and he had collected in Costa Rica and which they had arranged for reproduction as a colored plate in their book on Costa Rica soon to appear. He also exhibited plates showing the progressive steps necessary to produce the finished four-color plate. He also spoke of some of the peculiarities of these insects and why they chose them for their illustration.

A demonstration was made of a new stereopticon purchased by the Section.

Orthoptera.—Mr. Hebard exhibited a few specimens of earwigs showing extremes in size, the largest being 37 mm. and the smallest being 2.5 mm. in length. He also spoke about some of the interesting species of this family of insects.—E. T. Cresson, Jr., *Recorder.*

Entomological Workers of Ohio.

The Third Annual Meeting of Entomological Workers of Ohio was held at the Ohio State University on February 2nd, 1917, with thirty members in attendance. The program consisted of reviews of projects and reports on investigations of members of the Ohio Experiment Station, the State Division of Orchard and Nursery Inspection and the Department of Entomology of the University.

The following program was presented:

Distribution of Ohio Broods of the Periodical Cicada with reference to Soil, H. A. Gossard.

General Reports from Heads of Department Organizations:

H. A. Gossard, Ohio Experiment Station; N. E. Shaw, State Division of Orchard and Nursery Inspection; Herbert Osborn, Department of Zoology and Entomology, Ohio State University. H. A. Gossard, J. S. Houser, W. H. Goodwin, R. D. Whitmarsh, D. C. Mote and J. L. King, Reviews of Projects; Richard Faxon, Nursery Imports; F. D. Heckathorn, Winter Work in Nurseries and Surroundings; H. E. Evans, An Inspector's Itinerary for a Year; H. J. Speaker, Report of Control of Gypsy Moth Outbreak; C. L. Metcalf, Predaceous Insects; C. J. Drake, Notes on Aquatic and Semi-aquatic Hemiptera of Ohio; Herbert Osborn, Problems with Meadow Insects; T. L. Guyton, Aphididae of Ohio.

A permanent organization was effected and the following officers were elected for 1917-18: N. E. Shaw, *Chairman*; J. S. Houser, *Secretary.*

C. L. Metcalf, *Sec'y.*

EXCHANGES.

This column is intended only for wants and exchanges, not for advertisements of goods for sale. Notices not exceeding three lines free to subscribers.

☞ These notices are continued as long as our limited space will allow; the new ones are added at the end of the column, and only when necessary those at the top (being longest in) are discontinued

Diurnal Lepidoptera—Many rarities of North America to offer in exchange. Send lists of offerta to (Dr.) John A. Comstock, 1275 Bellevue Ave., Los Angeles, Cal.

For Exchange—Coleoptera, Lepidoptera, Hemiptera and Diptera, both native and exotic, named and undetermined. Also have Riker mounts and glass covered display cases to dispose of for specimens.—Harry L. Johnson, South Meriden, Conn.

For Exchange—First-class insects in mounts or pinned. Life histories, pairs or singles, for U. S. Dept. or old issue stamps.—E. F. Hitchings, Orono, Maine.

Wanted—Live healthy pupae of *Papilio ajax, eurymedon, Eudamus tityrus* and *Psychomorpha epimenis*.—Ward's Natural Science Establishment, 84-102 College Ave., Rochester, N. Y.

Native and Exotic Butterflies and Moths to exchange—Send lists to Joseph H. Reading, 1456 N. Rockwell St., Chicago.

For Exchange—Small collection of Hymenoptera (undetermined) for native or exotic Coleoptera. E. D. Quirsfeld, 42 Hudson Avenue, Union Hill, N. J.

For Exchange—Many species of *Catocala*, some rare ones. We would like in return any species that will add to our collection; also other moths and butterflies. Entomological Dept., Acad. Natural Sciences of Phila., Logan Square, Phila., Penna.

Wanted—Hesperiidae from all parts of North America. Will pay cash or exchange Iowa insects. A. W. Lindsey, 112 E. Bloomington St., Iowa City, Ia.

For Exchange—Duplicate Rhopalocera from Japan and Formosa; Desiderata; butterflies of the world. S. Satake, No. 48 Aoyamaminamimachi 5-chome, Akasakaku, Tokyo, Japan.

Any Group or order of insects collected this summer for Buprestidae and Longicorns from N. A. or for exotic Buprestidae. Desire to get in touch with interested parties. Alan Nicolay, 416a Grand Avenue, Brooklyn, N. Y.

WANTED—Papers published since 1894 and containing references to American Coleoptera, by Bernhauer, Grouvelle, Lesne, Leveille, Lewis, Pic, Otto Schwarz, Wasmann or other foreign authors. Will pay cash or give in exchange papers by American authors that I have in duplicate.—C. W. Leng, 33 Murray St., New York City.

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